the OIL AND GAS JOURNAL

Easy ON THE EYES!*

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"Red Top"

TONG DIES

ONLY THE TEETH

are hard...new BJ RED TOP dies are induction hardened *on the teeth* for sure grip and extra long wear... the rest of the die remains resilient to resist shock and chipping.

*Chip-proof ends guard against eye accidents

A "WHISTLE" IN EVERY BOX . . .

Look for the Miss BJ 'Red Top' pocket-size calendar card in the next box of BJ TONG DIES you buy. Collect a complete set of these doghouse pin-up poses!

HAVE YOU RECEIVED YOUR MISS BJ 'RED TOP' WALL CALENDAR?
Ask your BJ field representative

PRICE 50 CENTS

TABLE OF CONTENTS ON PAGE 1

APRIL 13, 1953

C&I helps

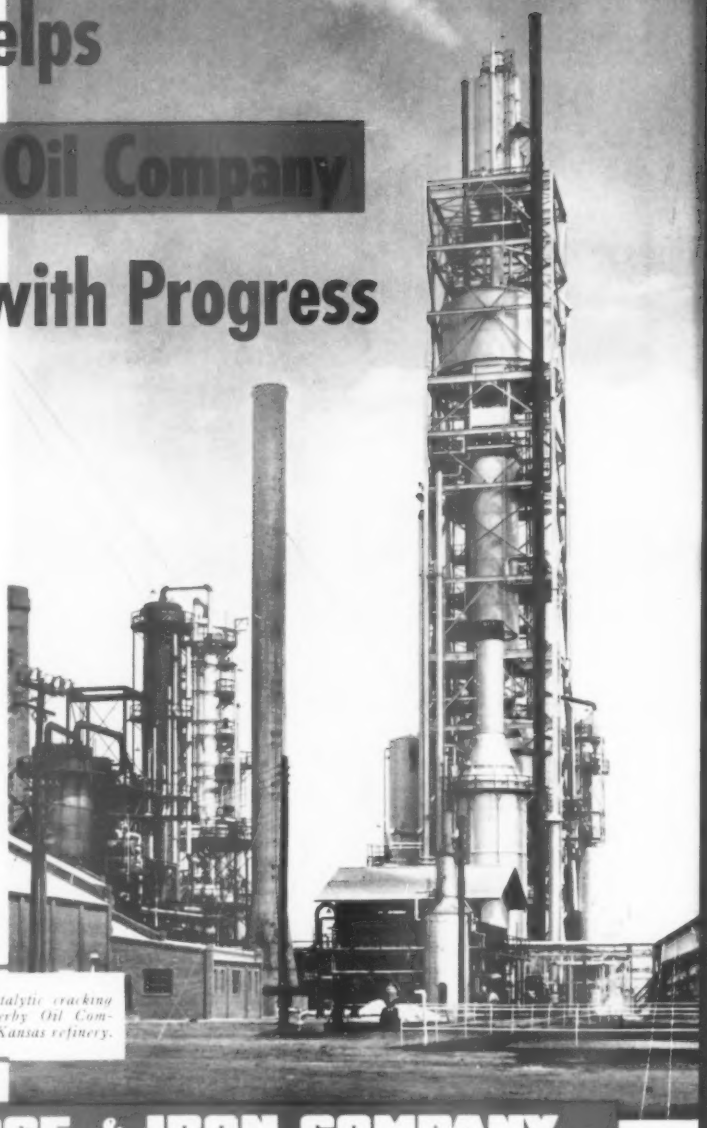
The Derby Oil Company

keep step with Progress

The Derby Oil Company is a progressive organization that recently completed an extensive revamping and modernization program at its Wichita, Kansas refinery. Equipment built by Chicago Bridge & Iron Company includes a stainless clad reactor, a kiln, a hot catalyst storage tank, and a catalyst tower for the TCC Unit. Also two refinery towers, a 10,000-bbl. Hortonsphere, a 25,000-bbl. tank and three 55,000-bbl. tanks equipped with Horton Floating Roofs.

Our completely-equipped design, fabrication and erection facilities qualify us to build all types of welded steel plate equipment for the petroleum industry. Careful engineering and complete supervision during erection assure you of structures that are built in accordance with the specifications.

For further information, estimates or quotations on Horton structures, write our nearest office. There is no obligation on your part.



View of new catalytic cracking unit at The Derby Oil Company's Wichita, Kansas refinery.

CHICAGO BRIDGE & IRON COMPANY

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

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Cleveland, 15 ..... 2204 Midland Bldg.
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Havana ..... 402 Abreu Bldg.
Houston, 2 ..... 2119 C. & I. Life Bldg.
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New York, 6 ..... 3347 165 Broadway Bldg.
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the OIL AND GAS JOURNAL

APRIL 13, 1953 VOL. 51 NO. 49

OIL IN THE NEWS . . .

Decline in Drilling, Production Worries Spraberry Operators ... 74
Gulf Enlarging Pilot Water Flood in McElroy Ranch Oil Field ... 75
Humble Reports Higher Costs Last Year Dropped Income $24,000,000 ... 76
Devonian Prospects in Central Pennsylvania Cited at A.P.I. Meet ... 78
Finding Enough Frequencies for Microwave Use a Chore, P.I.E.A. Told ... 79
Tennessee Gas Reported Seeking Stock in American Republics ... 79
Safety Not Easy to Come by; It Requires Work, Contractors Told ... 80
I.P.E. Expected to Attract 600 Visitors From Foreign Countries ... 81
O.W.I.U. Expected to Seek General Wage Hike of 7 Cents an Hour ... 82
Monsanto Reveals Plans to Build Huge Polyethylene-Plastics Plant ... 82
Shell Mines Its Own Drilling Mud in Ventura Avenue Field ... 83
South Louisiana Operators Cut Flaring 40 Per Cent in 18 Months ... 84
Justice Department Decision on Cartel Case Due Within 2 Weeks ... 86
Reciprocal Trade Act Hearing Will Open Next Week ... 86
Senate Minority Group Will Attempt to Delay Tidelands Bill ... 87
Pemex Planning Tamaulipas Refinery to Process Heavy Crude ... 91
Italian Refiners Bothered by Big Surplus of Light Products ... 93
Neutral Zone Wildcat Flows 4,500 Bbl. From Two Sands in Tests ... 94
Williston Wildcatting to Increase ... 173
Central Utah Gas Search Intensifies ... 174

NEWS FEATURES . . .

They Say ... 60
Calendar of Events ... 66
Journally Speaking ... 69
Editorial ... 71
This Week ... 73
Watching Washington ... 87
International News ... 88
Personals ... 95
Deaths in the Industry ... 97
Pipe-Line News ... 161
Natural-Gas News ... 164
Natural-Gasoline News ... 164
Refining News ... 165
Drilling Contractors ... 169
Active Rotary Rigs ... 169
Areal Field Reports ... 178
Exploration Statistics ... 194
Production Statistics ... 195
Refining Statistics ... 196
Market Statistics ... 197

TECHNOLOGY AND OPERATION . . .

[1]Hydraulic Problems of Trans Mountain Pipe Line ... 98
By Paul Reed
[2]Drilling Fluid for High-Temperature Formations ... 100
By T. E. Watkins
[3]Building Refinery Units—4 . . . Progress Reporting ... 102
By M. Mattozzi
[4]Combating Corrosion in Oil and Gas Wells ... 106
By Gerald L. Farrar
[5]Gas-Oil-Ratio Control in Thin Oil Columns ... 114
By R. C. Randal and J. H. Marchal
[6]Petrochemicals Unlimited ... 124
By Gustav Egloff
On the Job in Fields and Plants ... 136
Engineering Reference Section ... 139-150
Oil and Gas Equipment Digest ... 155

DEPARTMENTS . . .

Books ... 118
On the Job—Fields ... 136
On the Job—Plants ... 138
Engineering Reference ... 139
Engineering Fundamentals ... 141
Questions on Technology ... 143
Refiner's Notebook ... 145
Modern Drilling ... 147
Heat Transfer ... 149
Equipment Men in News ... 150
Equipment Digest ... 155
Classified Advertising ... 198
Advertisers' Index ... 203

In Brief . . .

1. PRESSURE LIMITING IS ECONOMICAL . . . Two pressure-limiting stations are used along the route of Trans Mountain Pipe Line. Savings of $5,000,000 have resulted, since usage of heavy-wall pipe has been avoided. The stations are of two types: one restricts downstream static head by tight shut-off during no-flow conditions; the other dumps oil through a battery of relief valves into tanks to reduce the pressure.

•

2. BETTER HIGH-TEMPERATURE MUD. Developed high-pH mud, of low lime and caustic contents, has these advantages: (1) It is more resistant to contaminants; (2) it can be used much longer at high temperatures before serious buildup of calcium silicate; (3) excellent S. P. logs are obtained; (4) handling is less hazardous; (5) chemical-treatment costs are lower; and (6) workovers are simplified.

3. MORE EFFICIENT CONSTRUCTION SCHEDULING . . . Scheduling of refinery units cannot be complete unless a close check is kept on the progress of the job. Four basic progress reports should be prepared and kept up-to-date during the construction: (1) drawing control, for coordinating drafting activities; (2) material status summary, for regulating flow of minor items; (3) construction progress report; and (4) job schedule progress report, for detailing over-all status.

•

4. COMBATING WELL CORROSION . . . Approximately 30 per cent of the country's low-pressure sweet-oil wells are economically affected by water-dependent corrosion, average cost being $960 per well. Most widely practiced mitigation is by means of chemical inhibitors. Most failures in oil-well casing are due to corrosion. Several methods are effective for mitigation. Organic inhibitors are used most often to control corrosion in condensate wells.

•

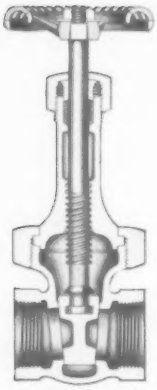
5. INCREASED OIL RECOVERY . . . Use of intermitters in thin oil columns means increased oil recovery for entire life of well. More even pressure distribution is obtained, thus providing for more effective drainage and more regular advance of gas-oil contact plane.

•

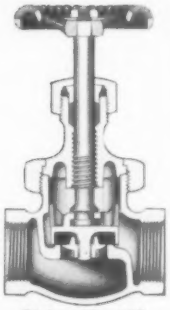
6. PETROCHEMICALS UNLIMITED . . . Petrochemicals now supply 25 per cent of total chemical production, and are expected to be supplying about 50 per cent in less than 10 years. The industry is now valued at over 2 billion dollars. Valuation will increase to nearly 3 billion dollars before 1955.

Underwriters' Approved and Crane Quality too!

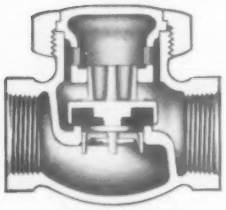
BRASS VALVES for LP-GAS



Gate—No. 422



Globe—No. 130



Check—No. 132

Angle—No. 131

Double assurance of conformity to standards—of dependability, safety, and low-cost long life—in these valves for use in storage piping, customer installations, and on distribution equipment.

That's what you get in Crane Underwriters' approved Brass Valves for LP-Gas. Crane designs and builds these valves not merely to meet the standard requirements, but to win your complete confidence with extra quality and added service features.

In steel valves and fittings as well, the Crane line gives you complete selection in all patterns and sizes, with complete suitability for LP-Gas. Here, too, the name Crane is a trustworthy guide of thrifty buyers of LP-Gas piping equipment.

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WORKING PRESSURE: Underwriters' approved for LP-Gas up to 250 pounds maximum. SIZES: ¼ to 2 in. inclusive. NOTE: Globe and angle valves have composition disc, with easy-to-change, slip-on disc holder. FULL INFORMATION in Your Crane Catalog, or in LITERATURE FREE on request.

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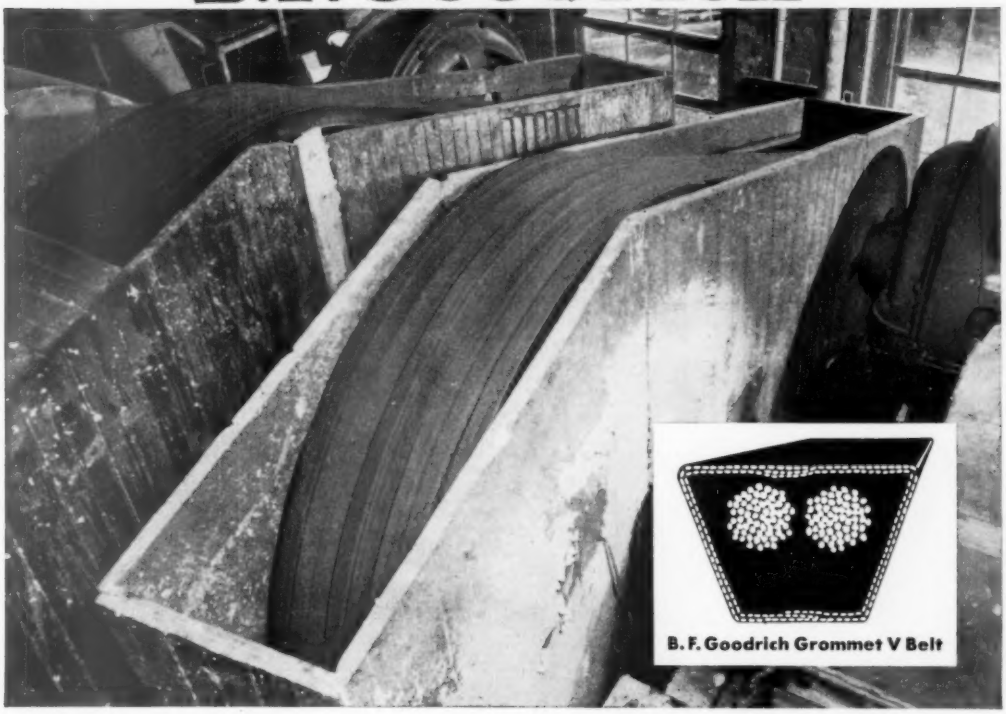
RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



11 to 1 service record proves B. F. Goodrich belts last longer

User reports 3-way saving with grommet V belts

ORDINARY V belts on these drives lasted only a year. They couldn't take the 24-hour-a-day service, the heavy loads. Covers would separate from the belt, flap around the drive, get caught in pulleys, then tear off completely. Then a B. F. Goodrich distributor recommended grommet V belts. It proved to be a perfect solution. Installed in 1941, both sets of grommet V belts have already lasted 10 times longer, and still look good for years' more service. Here's why BFG grommet belts outlast and outperform ordinary belts:

No weak spots

The section where cords overlap is the weak spot in ordinary belts. That's where 85% of belt failures occur. But in B. F. Goodrich grommet V belts this cause of belt failures has been eliminated. All of the cord material in a grommet belt is *concentrated* in twin grommets. These grommets are cord loops, made like giant twisted cables except that they're endless. There are no splices or overlaps—no weak spots to cause premature belt failures.

Better grip, less slip

Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip, there is also less surface wear.

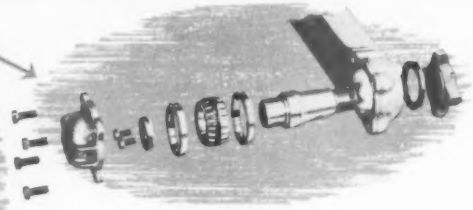
Save 3 ways

This company, like many others, is making a 3-way saving with grommet V belts. First, they save on replacement costs because grommet belts last longer. They save on production costs with no shutdowns caused by belt failures. And they save on maintenance costs because these belts need less attention. Yet the savings they make are clear profit because grommet belts cost not one cent more than ordinary V belts. Next time you need V belts, order *grommet* V belts from your BFG distributor. *The B. F. Goodrich Company, Industrial & General Products Division, Akron, Ohio. (Available in Canada).*

Grommet V-Belts BY
B.F.Goodrich
FIRST IN RUBBER

2 more reasons... why "Oilwell" Pumping Units

give you LONGER SERVICE LIFE

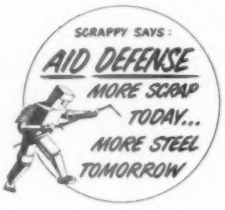


Wrist Pins with Solid Housings and Self-Aligning Bearings

Pumping Unit wrist pins have three critical operation factors. They must (1) rotate freely, (2) carry overhung loads and (3) withstand frequent stress reversals. On "Oilwell" units, heavy-duty wrist pins of alloy steel are mounted in double-row, self-aligning roller bearings. This fully enclosed assembly nests in a spherical one-piece steel housing at the end of the pitman and is grease lubricated through a weatherproof housing-cover equipped with pressure relief fittings. The pin for the crank connection extends through a grease seal and is held securely in the crank by a taper fit and drive-lug nut with locking arrangement. ***With this construction, the pin rotates freely in the pitman under all conditions, there are no bolts in tension and pitman twisting problems are avoided.***

Three Keyways on Gear Shaft Extensions

Scientific counter-balancing reduces the severity of peak-loads, but mechanical limitations make it impossible to eliminate them completely in the gear train. Loads are evenly distributed by mechanical means over the circumferences of pinion and intermediate gears. But since the main gear must be keyed to the cranks, loads recur on identical segments with each crank revolution; reaching their peaks of intensity each time the crank is in horizontal positions. On "Oilwell" Pumping Units, three keyways—120 degrees apart—are provided on the shaft extension of main gears in sizes D-7 and larger. By progressively using these keyways to change the relative position of the cranks, peak loads are made to occur over the six corresponding segments of the gear face. ***This, in effect, extends the useful life of the main gear threefold.***



ASK . . . your "Oilwell" Representative—about the other features in "Oilwell" Pumping Units which save you money—now and later.

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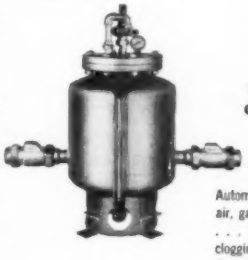
YOU CAN *Remove and Replace Without Shutdown*

Union connections between the gage and the valves permit removal of gage for repairs without shutting down the equipment. Just close the valves, uncouple the unions and remove the gage. The convenience of this is obvious. When glasses have to be replaced or repairs made, it is not necessary to work in an awkward position or to shut down. Another advantage: a gage needing repairs can be replaced immediately by a spare and the repairs made at leisure. There are many other reasons for the superiority of Penberthy Liquid Level Gages; ask for Catalog 35.

OTHER PENBERTHY PRODUCTS

PENBERTHY TRANSPARENT GAGE

Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction—liquid chamber machined from solid block of metal. Ask for Catalog 35.



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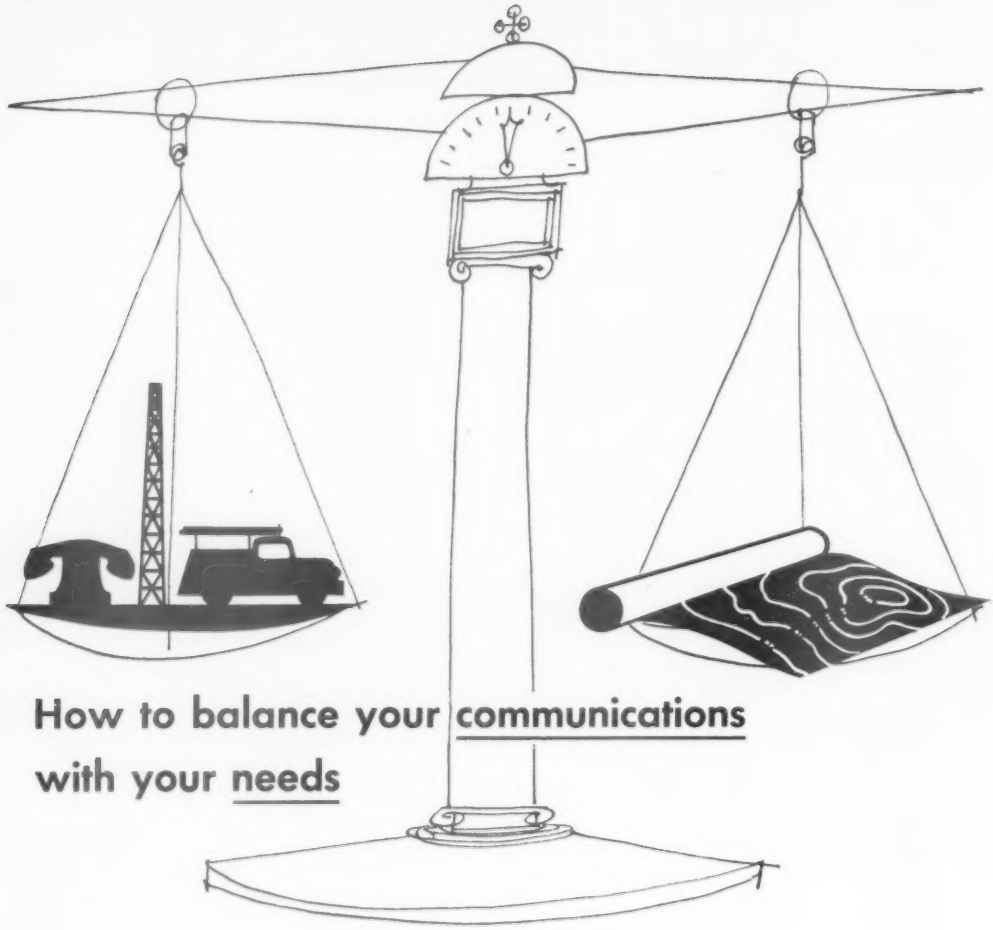

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From site preparation to final clean-up, no single piece of equipment is as useful as a Caterpillar D6 Tractor equipped with a No. 6A Bulldozer.

"We use Cat* machines from 'the cradle to the grave'," says Lyle Ostrander. "Since we bought our first piece of Caterpillar equipment 15 years ago, we have tried to standardize on them."

Mr. Ostrander is pipe-laying foreman for Otis Eastern Service, Inc., Wellsville, N. Y. The company's handy, rugged D6 is shown filling around valve boxes after a drill rig has been moved at Lock Haven, Pa.

The D6, equipped with a bulldozer and a Hyster 6N Winch, is used by Otis Service to lay pipe, clear out for locations, and for cleaning up after drilling and abandoning wells.

The talented Cat angling-type Bulldozer is master of any job it tackles. Deftly taking large loads, it holds them on the blade and puts them where needed. The blade, sturdily built of five box sections, can be angled into three positions by one man.

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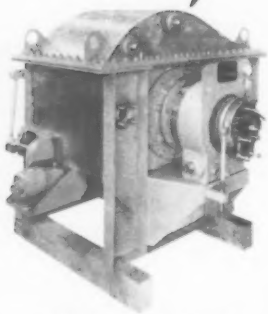
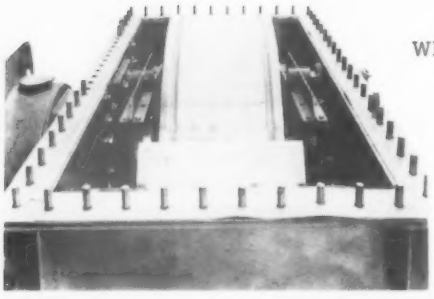
sulphuric acid, nitric acid and potassium permanganate safely handled by Stainless #20





The materials handled by this continuous vacuum filter are not only corrosive but toxic. The principal corrodent in the filtrate is sulphuric acid (PHI). The solutions used for periodic cleaning of the filter are nitric acid and potassium permanganate.

To withstand this combined attack, all parts of the filter that come in contact with slurry, cake or filtrate are made from Carpenter Stainless #20—sheet, pipe, nipples, electrodes, rounds, etc. The hood to contain the gases is made from Carpenter stainless sheet, type 316.

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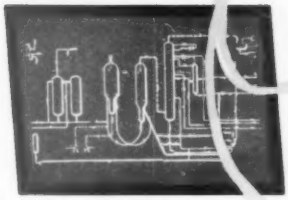
...that expedites conversion from a flow diagram to a complete refinery.



This catalyst is the product of a precisely controlled integration of the functions of design, engineering, fabrication and construction. Its essential characteristic is service.
It has saved and is saving Foster Wheeler clients time and money.

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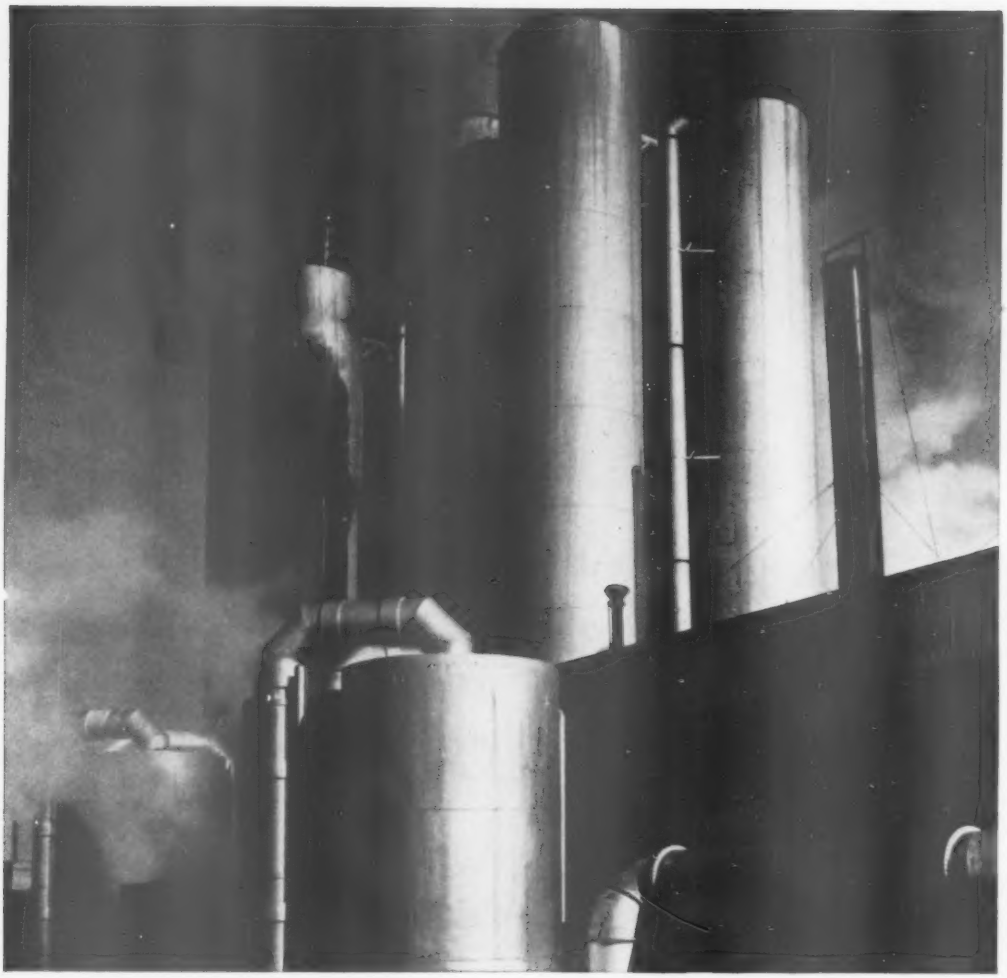

There's a special paint for places like this and it saves hundreds of dollars

When you get down to figuring how much it costs to paint a square foot of tank or stack, you find that the paint itself is only a small part of the cost. That's why experienced paint buyers select more quality aluminum paints for jobs like this than any other type.

Because so much aluminum paint is used for these places, special formulas have been developed. Paints made to these formulas stand up longer under heat, cold, sun, rain and the kind of corrosive fumes you find around mills and factories.

We don't make paint. But we make the Alcoa Aluminum Pigments that are used in more aluminum paints than any other brand. So we want to be sure that you get full value from the aluminum paint you buy. It's just good business for us.

If you have a plant, or a stack, or storage tanks, or most anything else that needs paint that will last a long time, write us about your paint problem and we'll tell you what types of aluminum paints are best. We'll also send you a copy of *Painting with Aluminum*. It's packed with facts on selecting and using aluminum paints. Paint Service Bureau, Aluminum Company of America, 1791-D Alcoa Building, Pittsburgh 19, Pa.

Alcoa Aluminum

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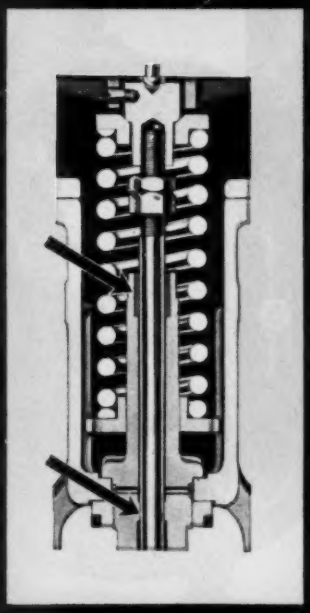

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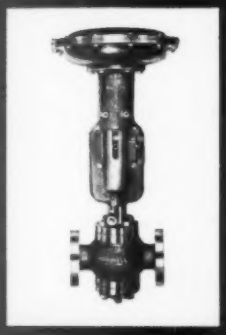
for smoother stem movement



The two-point guiding of the upper stem in the Honeywell Series 700 Valve eliminates side thrust by supporting the stem at top and bottom in continuously lubricated bearings . . . assuring practically frictionless response to the slightest changes in signal air pressure. The Honeywell Series 700 wide band proportional valve comes in a full range of styles and sizes . . . has *all* the features you look for in a fine valve. Write today for your copy of Bulletin 700-2.

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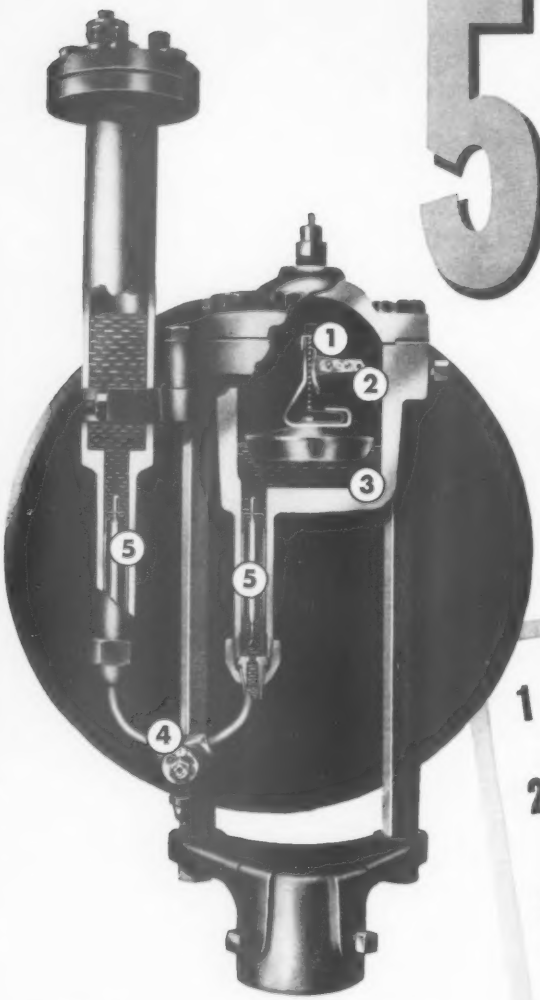
VALVE PRODUCTS

First in Controls



5 basic advances that mean BETTER FLOW METERING!

1 **New Segmental Drive Assembly** — stainless steel ball-type chain insures perfect alignment and friction-free travel of float.

2 **New Pressure-Seal Bearing** — stainless steel with exclusive seal ring . . . gives unmatched freedom at any working pressure from friction, maintenance and leaks. No lubrication required.

3 **New Compact Float Chamber** — greater accessibility for easier, quicker cleaning.

4 **New U-Bend and Damping Plug Assembly** — self-aligning, all-welded construction . . . no gaskets required. Calibrated damping plug fully adjustable under pressure. Directed drain for mercury at lowest point.

5 **New Check Floats** — with positive-seating stainless steel ball plug. Submerged in mercury for complete protection against dirt and corrosion.

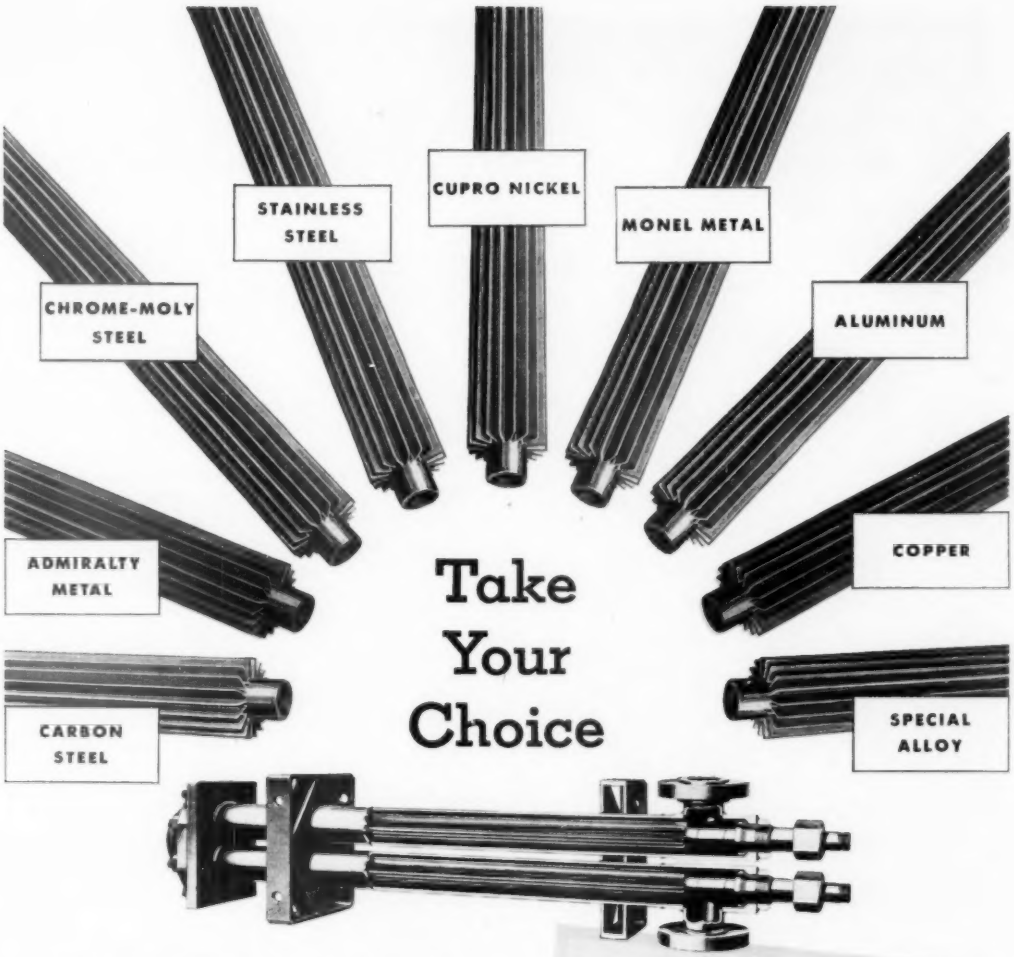
With major improvements in every basic detail, the complete new line of Foxboro Flow Meters now gives metering performance that's farther ahead of the field than ever before!

In addition to the outstanding advances illustrated, these new meters incorporate many other superior features, including: interchangeable parts; large floats with long travel for added power; and float in high pressure chamber to minimize ambient temperature effects.

Write for new Bulletin 460. It describes the complete new line . . . indicators, recorders, controllers, transmitters . . . with round or rectangular cases . . . with and without integrators. The Foxboro Company, 604 Neponset Ave., Foxboro, Mass., U.S.A.

FOXBORO
Reg. U. S. Pat. Off.
First in FLOW METERS

FACTORIES IN THE UNITED STATES, CANADA AND ENGLAND



Take Your Choice

ANY METAL used in heat transfer apparatus can be used for the G-Fin elements of Twin G-Fin Sections.

Therefore, when you purchase these units for your particular heating, cooling, condensing or heat exchange service, you can be sure that the complete heat transfer elements can be made of the most suitable material for the purpose.

This is but one of many Twin G-Fin Section advantages. For the complete story, write for bulletin.

THE GRISCOM-RUSSELL CO.
MASSILLON, OHIO

Note these Twin G-Fin Section Features

Simple . . . has fewer parts than any heat exchanger on the market

Adaptable . . . can be used on a wider range of services than any other design

Standardized . . . for lower price and quicker shipment

Convenient . . . easy to transport, install and maintain

Durable . . . proven by 20 years of service and more than 70,000 installed units

G-R Twin G-Fin Sections

HEAT TRANSFER APPARATUS

GR 305

The Right Wire Rope will do the trick!

World's deepest with 12,000-ft.

THEY'RE down 11,045 ft. by cable tool and still going. It's the deepest well ever drilled by cable tool; it's New York State Natural Gas Co.'s new well at Van Etten, N. Y.

The drilling rig is equipped with American Tiger Brand tapered drilling and sand lines, both of which are the *longest* tapered lines ever made. American Steel & Wire engineered them especially for this tough job.

Acme Drilling Co. of Greensburg, Pa. started the well for New York State Natural Gas Co. with a competitive line. After reaching a depth requiring a tapered line, a competitive line was used. When that one wore out, the two companies concerned asked for a line with continuous tapered sections that would assure them the longest possible service at reasonable cost. New York State Natural Gas Co., Acme Drilling, and American Steel & Wire personnel got together to discuss the problem. Our engineers went to work and came up with two 12,000-ft. lines that give excellent service

A SPECIAL 12,000-FT. tapered Tiger Brand Drilling Line has taken this cable tool well down to a record-breaking 11,045 ft. American Wire Rope Engineers designed this line specially to meet the tough requirements of this job.

CLAMPING THE DRILLING LINE. Both this line and the sand line, used for bailing, are continuous tapered Tiger Brand Lines. Each one is 12,000-ft. long—the longest tapered lines ever made.

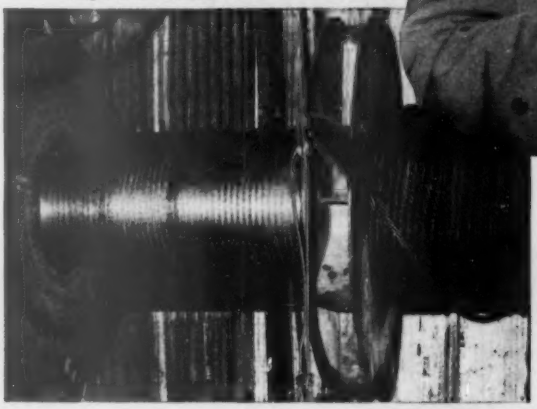
cable tool well drilled Tiger Brand Tapered Wire Line

under the extreme abrasive wear encountered in this deep well. They are performing so well that the New York State Natural Gas Co. has ordered *another* identical Tiger Brand Tapered Drilling Line for use when the present one eventually wears out.

American Wire Rope Engineers can design a suitable wire rope for *any* special job you may have. And when they do the engineering, you can be sure of getting just the right combination of strength, durability and flexibility. Get in touch with the nearest sales office for their help.

MEASURING THE DIAMETER of the drilling line to check for wear. This special Tiger Brand Line is holding up so well that New York State Natural Gas Co. has already ordered another Tiger Brand Line just like it.

THIS IS THE BULL WHEEL WITH the 1" section of drilling line still wound on it. This line tapers from 1" down to ⅝" at the tool end. Additional strength and diameter is needed at the top to support the weight of the line and tools.



FOR THE EVERYDAY JOBS, GET THIS HANDY GUIDE BOOK

Most of your tough rope jobs can be handled efficiently with one of the several hundred *standard* Tiger Brand Wire Lines. This "Wire Rope Recommendation Book" tells you which one to use for each job . . . helps you get the *right* rope every time. Just send the coupon.

American Steel & Wire
Dept. P-48, Rockefeller Bldg.
Cleveland 13, Ohio

Please send me, without obligation, a copy of your "Wire Rope Recommendation Book."

Name.....

Company.....

Address.....

City & State .....

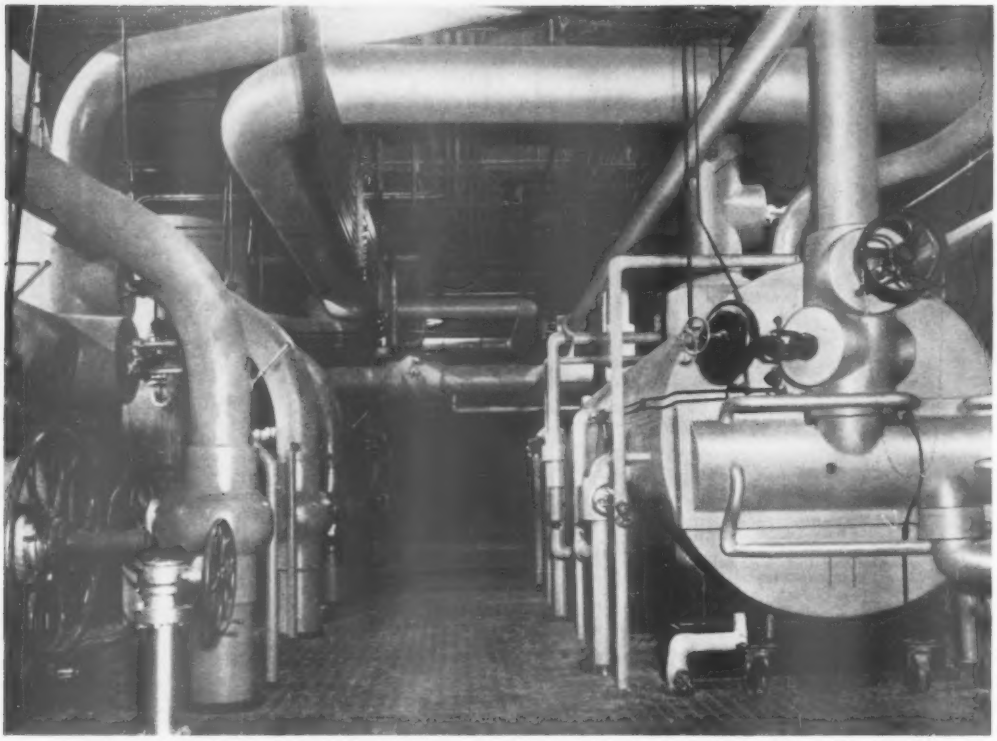
AMERICAN STEEL & WIRE DIVISION
UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

U·S·S AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL



Scene in large southern power station. Main steam line and feeder equipment insulated with K&M Hy-Temp and "Featherweight" 85% Magnesia, in combination

Save heat-Save dollars

with K & M high-temperature insulations

For applications up to 1900°F., the combination to keep in mind is that of K&M Hy-Temp Insulation and "Featherweight" 85% Magnesia.

Two separate layers of insulation with vertical and horizontal staggered joints eliminate heat loss which occurs when expansion of hot piping and equipment causes joints to open in single layer installations. K&M Hy-Temp Insulation (diatomaceous silica), effective up to 1900°F. is applied directly to the hot surfaces and "Featherweight" 85% Magnesia Insulation (85% basic carbonate of Magnesia and asbestos fiber), effective up to 600°F. forms the second layer.

This effective K&M combination will last the life of the equipment it serves —will withstand moisture, vibration, alternate heating and cooling, wetting and drying. Both materials are supplied in all appropriate forms and thicknesses.

Your K&M distributor is an experienced applicator who will gladly give you more information about these heat-saving, money-saving K&M insulations. Or write directly to us.

Nature made Asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

Chase Antimonial Admiralty

(a patented alloy)

Every Chase Antimonial Admiralty heat exchanger tube is tested to withstand at least 1,000 pounds per square inch water pressure.

Meets every test for Heat Exchanger Tubes

Chase flattening test, index of Antimonial Admiralty tube's physical quality and ability to withstand bending or end flaring.

This Chase metallurgist is checking the size and uniformity of grain of Chase Antimonial Admiralty heat exchanger tubes.

When you put Chase Antimonial Admiralty* tubes into a heat exchanger you *know* they'll stand up for years. It isn't only that we make certain there's enough antimony to resist dezincification. Chase heat exchanger tubes are carefully tested and retested for *every* physical and chemical property required to meet actual field conditions. It pays to insist on Chase Antimonial Admiralty.

*U.S. Pat. No. 2,061,921

Chase BRASS & COPPER

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ALL FORGED STEEL

Edward

STOP AND CHECK VALVES

For Pressures Up To 7500 lbs.

Rated for 7500 lbs. at 125F in 2 in. sizes, and for 6000 lbs. at 125F in the ½ to 1½ in. sizes, Edward's complete line of all forged steel high pressure valves are used in thousands of applications involving excessive pressures and temperatures under 300F. Fig. 158 stop valves, in either globe or angle styles, provide fast, certain shut-off or accurate pressure control. Fig. 160 check valves protect costly equipment, eliminate danger by preventing sudden reversal of flow.

FIG. 158

Construction Features Like These Give Longer Life, Reduce Replacement Costs And Lower Maintenance Time:

FIG. 158 STOP VALVES

- Drop forged steel bodies specially heat treated.
- Stem at 60 degree angle to reduce wear producing turbulence, lower pressure drop.
- Seat, disk, and stem of EValloy 13% chromium stainless steel.
- Renewable screwed in seat with long threads below pressure joint for leak proof seating
- Inside screw construction, deep stuffing box and special gland and packing nut design to lengthen packing life.
- Bonnets EValized by exclusive plating process for maximum corrosion and abrasion resistance.
- Body contours streamlined for free flow with low pressure drop.
- Stem of EValloy stainless steel, centerless ground to fine finish, long wearing Acme form threads, backseating shoulder.

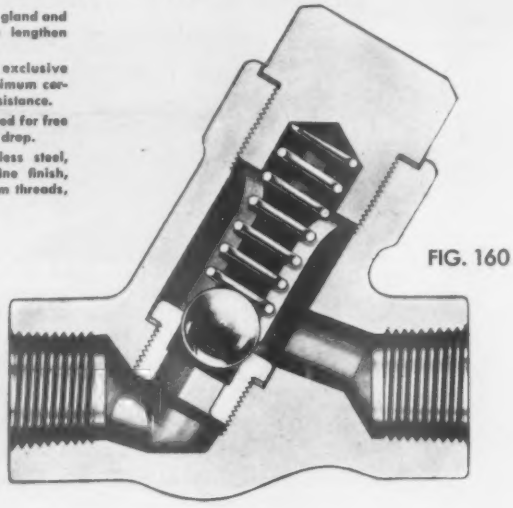


FIG. 160

FIG. 160 CHECK VALVES

- Body and seats identical with globe or angle valves above.
- Rolled steel bonnet with two ribs for guiding ball to accurate seating.
- Balls of corrosion resistant, high carbon stainless steel accurately ground for tight seating.
- High Carbon stainless steel springs, sufficiently long to provide positive aid in seating ball in services involving heavy viscous fluids.

Available In Wide Range of Sizes and Styles

- Stop valves furnished in globe or angle styles.
- Check valves furnished in horizontal or vertical styles.
- All valve styles furnished in sizes ¼", ⅜", ½", ¾", 1", 1¼", 1½", 2".
- All valve styles furnished with either screwed or socket welding ends.

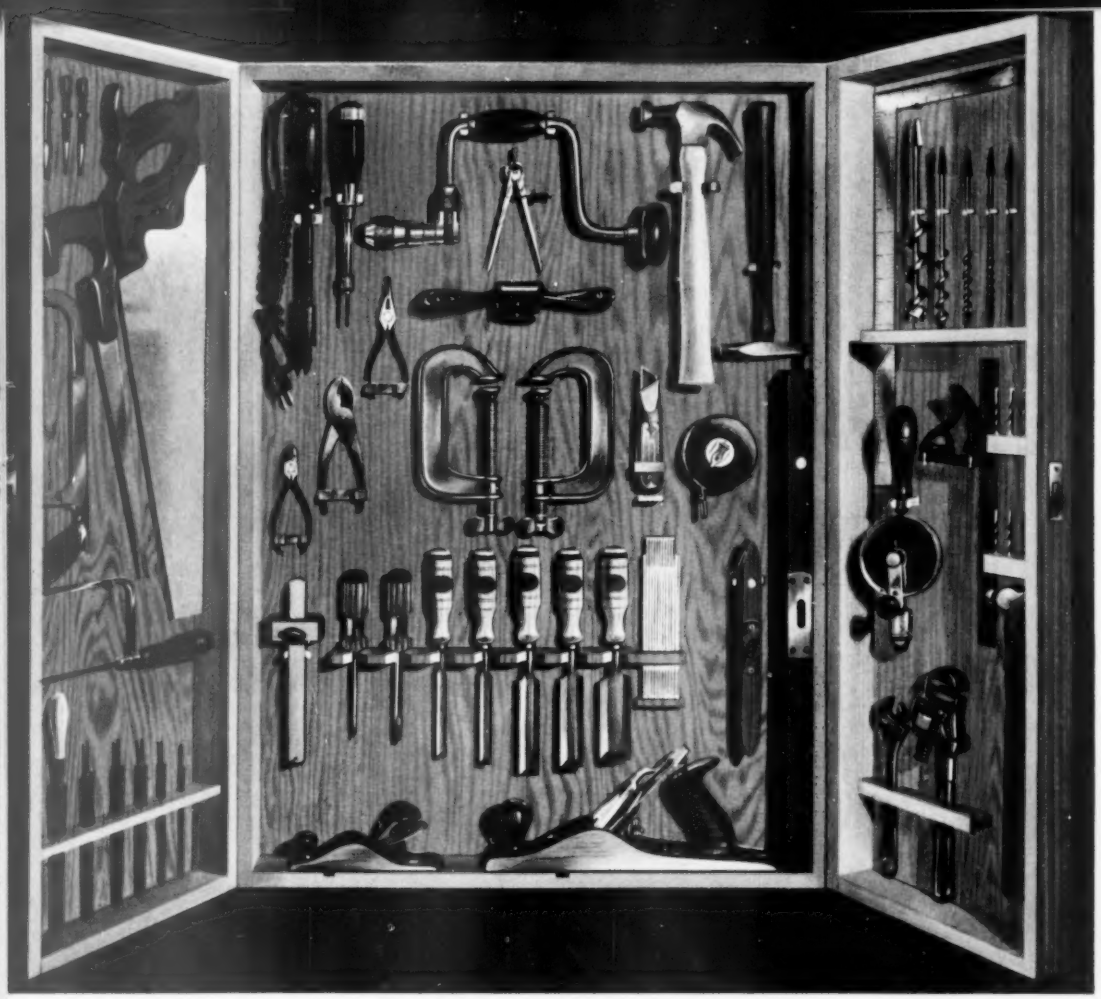
Edward builds a complete line of cast and forged steel valves for pressures from 150 lbs. to 7500 lbs., including globe and angle stop valves, gate valves, non-return valves, blow-off valves, feedline stop-check valves, integral bonnet Univalves, relief valves, hydraulic valves, instrument valves, gage valves and strainers. Write for Catalog 104.

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

1492 West 145th Street, EAST CHICAGO, INDIANA

Another Product



A tool chest that has everything

You can see at a glance that this handsome chest contains about everything you need to do a good job. It isn't quite so easy to picture the many "tools" in the Ethyl service chest. But it has everything you need, too. For Ethyl offers a set of time-tested tools . . . developed through thirty years of experience.

Take Ethyl's sales tools, for example. Continuous advertising of "Ethyl" gasoline over the past three decades has helped refiners establish the premium gasoline market as we know it today. Over the years billions of magazine, billboard, radio, television, and drive-in movie messages have been beamed to the motoring public. And to carry through at the point of sale, educational programs have been devised for dealers—such as the Product Sales Clinic, which has been attended by more than 62,000 dealers, salesmen, and marketing people.

(*Continued on next page*)

Printed in U.S.A.

A tool chest that has everything

(*Continued from preceding page*)

Special tools have been forged to meet the problems of specific markets. For example, Ethyl's farm program helps petroleum marketers sell more gasoline and lubricants for tractors—and Ethyl's fleet program is designed for the bus and truck field.

Ethyl has also developed precision tools to assist refiners to produce high-quality regular and premium fuels. Included are extensive Research Laboratories with twenty years of practical experience in fuel, engine and lubricant problems, a road testing program to prove laboratory findings under field conditions and a nation-wide gasoline testing program to keep you accurately posted on fuel trends.

What makes this set of service tools so valuable is that they are in the hands of experienced men. Ethyl has been in the antiknock business longer than anybody else . . . and it is our aim at all times to make available to our customers everything we have learned.

ETHYL CORPORATION

NEW YORK 17, NEW YORK

Ethyl service is backed by 30 years of antiknock experience

RESEARCH

SALES HELPS

SUPPLY SERVICE

ROAD TESTING

TECHNICAL REPORTS

GASOLINE TESTING

TIMKEN® bearings on fastline sheave give advanced design to Moore 133 ft. mast

LEE C. MOORE CORPORATION mounts the 56" fastline sheave of its 133' Cantilever drilling mast on Timken tapered roller bearings.

TO take the side thrust, Lee C. Moore Corp. mounts the 56" fastline sheave of its 133' Cantilever drilling mast on Timken® roller bearings.

The tapered construction of Timken bearings enables them to take both thrust and radial loads in any combination. The fastline sheave is kept in positive alignment. And Timken bearings carry the heavy loads with ease because line contact between the rollers and races gives them extra load-carrying capacity.

Lee C. Moore has found that Timken bearings make closures more effective because they keep housings and shaft concentric. Lubricant stays in—dirt, moisture, sand stay out. Maintenance and lubrication time is reduced.

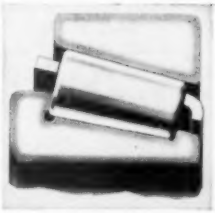
Specify Timken bearings for all the oil field equipment you build or buy. The trade-mark "Timken" is your guide to top value. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



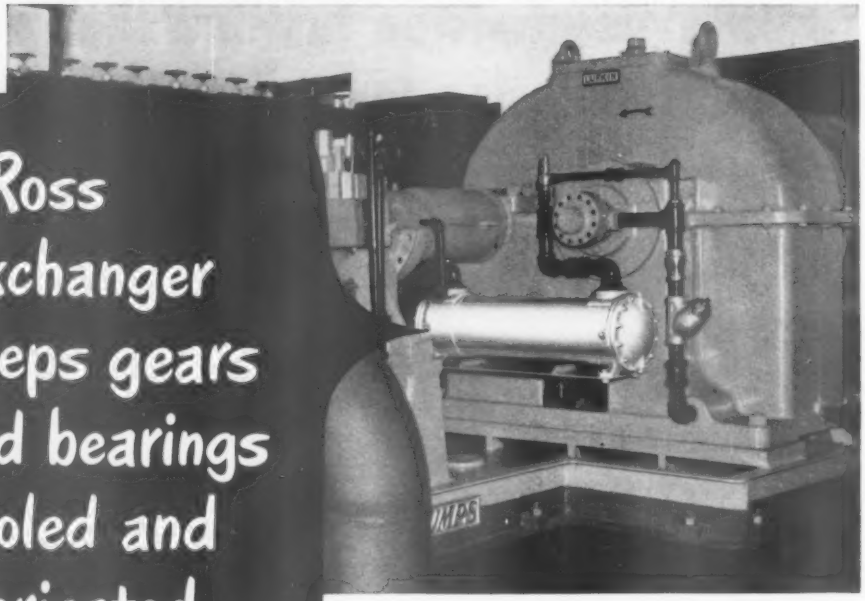
HARD ON THE OUTSIDE, TOUGH ON THE INSIDE

Rollers and races of Timken bearings are case-carburized to give a hard, wear-resisting surface and a tough, shock-resisting core. Result: longer bearing life.

The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis Timken steels.

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⬭ AND THRUST →⬭← LOADS OR ANY COMBINATION

a Ross Exchanger keeps gears and bearings cooled and lubricated



in this Lufkin high speed increaser

Under the high speeds and peak loads of pipe line pump station service . . . precision gears and bearings in this Lufkin Type N High Speed Increaser not only *need* adequate lubrication and cooling . . . *they depend on both!*

. . . *and they get both!* Lufkin Foundry and Machine Company furnishes a Ross Type BCF Exchanger. "A most vital part of the cooling system," says Lufkin. By controlling the oil temperature in this way, not only is viscosity maintained for adequate lubrication of gears and bearings, but they are properly cooled as well.

Why Ross Exchangers?

Here's what Lufkin's Engineering Department has to say:

"We wanted a quality exchanger that we could install and forget."

"Our unit required a large capacity exchanger for a small, compact space . . . without altering the design of the unit."

"Since we have 33 sizes of Type N units, we needed to have many different sizes of exchangers."

"Very often the customer has to use salt water or sour crude as a cooling liquid."

"The pressure of the cooling liquid sometimes becomes excessive for most exchangers."

Throughout industry, other top-name machinery manufacturers, like Lufkin, list equally specific reasons for standardizing on Ross Type BCF Exchangers. They prefer the pre-engineered, completely standardized designs; the all-copper and copper alloy construction and the wide range of sizes to meet all conditions.

More details on the rugged dependable Ross Type BCF Exchanger are in Bulletin 1.1K5. Write for your copy.

KEWANEE-ROSS CORPORATION

DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

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In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

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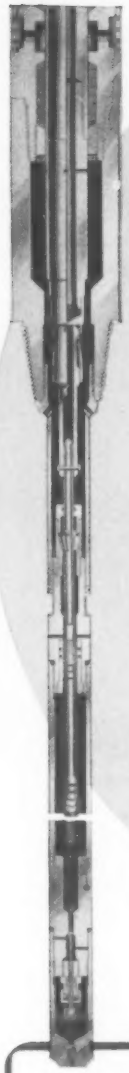
PROVED...

...in THREE YEARS of Successful Operation

The JOHNSTON Reservoir Fluid Sampler

● The Johnston Reservoir Sampler secures a representative sample of reservoir fluid for laboratory analysis (1300 cc's) providing the reservoir engineer with data as to fluid characteristics and possible reservoir behavior weeks . . . even months . . . in advance of conventional methods. This service is available at a small extra cost WITH EVERY JOHNSTON TEST.

A copy of Treatise covering full details of this product will be sent you upon request.



Sampler Attached to Shut-in Pressure Valve in Testing Assembly.

Sampler Removed from Testing String as Shipped to Laboratory with Transfer Head.

JOHNSTON TESTERS, INC.

POST OFFICE BOX 165 HOUSTON, TEXAS

EXPORT DIVISION: 3035 Andrita St., Los Angeles 65, California

SERVICE BRANCHES IN ALL ACTIVE AREAS

There's a Johnston Service Representative Near You

FORMATION AND CASING TESTING — JOHNSTON

Bucyrus-Erie cable or hydraulic Bullgrader can be easily angled right or left and tilted vertically.

Save Time and Money On Jobs Like These...

- Digging slush pits
- Clearing and leveling land
- Building and maintaining access roads
- Building dikes and fire walls
- Digging and backfilling pipe trench
- Miscellaneous oil field jobs

Bucyrus-Erie bulldozers are offered with either cable or hydraulic control . . . blade remains in one position — straight ahead.

HERE are just a few reasons why you can cut costs on a variety of dirt moving jobs with Bucyrus-Erie hydraulic or cable Bullgraders and bulldozers:

They're designed and built exclusively for International crawlers to give you full advantage of tractor power.

There's accurate and instant control response for operators with either cable or hydraulic rigs. Low pressure hydraulic system supplies ample power without hydraulic hammer, excessive heating or pump wear. Front- or rear-mounted power control winches of improved planetary design give smooth-flowing power and unfailing, snappy action.

Bucyrus-Erie's scientifically curved moldboard *rolls* dirt instead of just pushing it. Lower load resistance means more dirt moved with less power.

There are many more advantages of Bucyrus-Erie Bullgraders and bulldozers. See your International Industrial Tractor Distributor soon . . . it'll be the right step toward cutting your dirt moving costs.

Cable operated Bullgrader and bulldozer equipment is available for International TD-14A, TD-18A, and TD-24 tractors. Hydraulically controlled Bullgrader and bulldozer equipment is available for all International tractors up to and including the TD-18A. 206T52

BUCYRUS-ERIE CO. • South Milwaukee, Wisconsin

BUCYRUS ERIE

See Your

INTERNATIONAL
Industrial Tractor
Distributor

Hand-tailored to any size you need...

...Goetze Heat Exchanger Gaskets are precision-made for longer service

Whether your requirements call for heat exchanger gaskets larger than 100" in diameter, or smaller than 10", you can get the exact size you want . . . hand-tailored to the shape you need . . . simply by specifying "Johns-Manville Goetze."

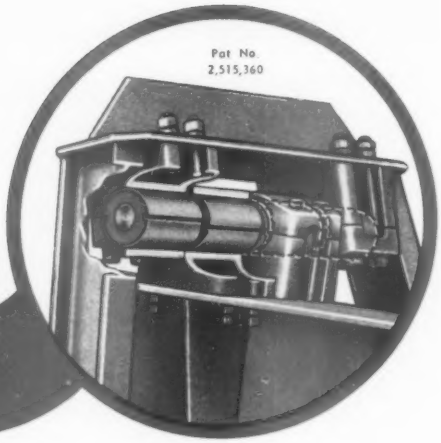
And because they're *precision-made*, you'll find these better gaskets provide the effective sealing and longer life that make them actually cost less in the long run. Each gasket is carefully constructed in every detail to assure accuracy of fit . . . to provide ample lap widths and uniform rib widths . . . and to prevent trouble-making wrinkles or cracks on the corners.

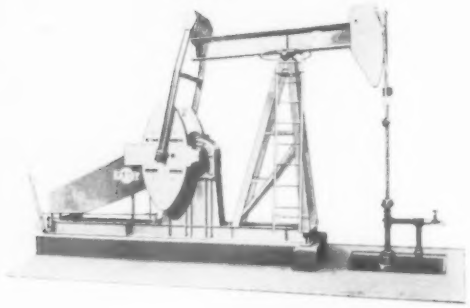
If you're having trouble with persistent joint leakage and frequent gasket replacements, find out how little it costs to have Goetze Heat Exchanger Gaskets tailored to your requirements. Your blueprint or template will bring a prompt estimate. Address Johns-Manville, Box 290, New York 16, New York.

Johns-Manville *Goetze* GASKETS

THERE'S A JOHNS-MANVILLE PACKING AND GASKET FOR EVERY SERVICE

NEVER LUBRICATE THIS BEARING





This Equalastic* Bearing, like the tires and spring shackles on your car, is made of tough rubber. Torsional deflection, in lieu of metal-to-metal, takes care of the oscillating movement. There is no friction, and therefore no need of lubrication.

This rubber bearing also has the obvious advantage of absorbing well shocks and high frequency vibration from the prime mover. Dynagraph tests show a substantial reduction in maximum polish rod load.

Your J&L supply store can recommend for any well a Cabot unit that will do a dependable, economical job. There are 15 basic sizes and more than 35 assemblies. A Cabot owner can change reducers if his requirements change.

You'll like everything about Cabot pumping units and the service that goes with them. Delivery to your lease can be made on Cabot trucks in charge of men trained in assembly and service.

Let's talk Cabot right away!

CABOT®

Exclusive Distributors

PESA

*Reg. U. S. Pat. Off.

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SUPPLY DIVISION

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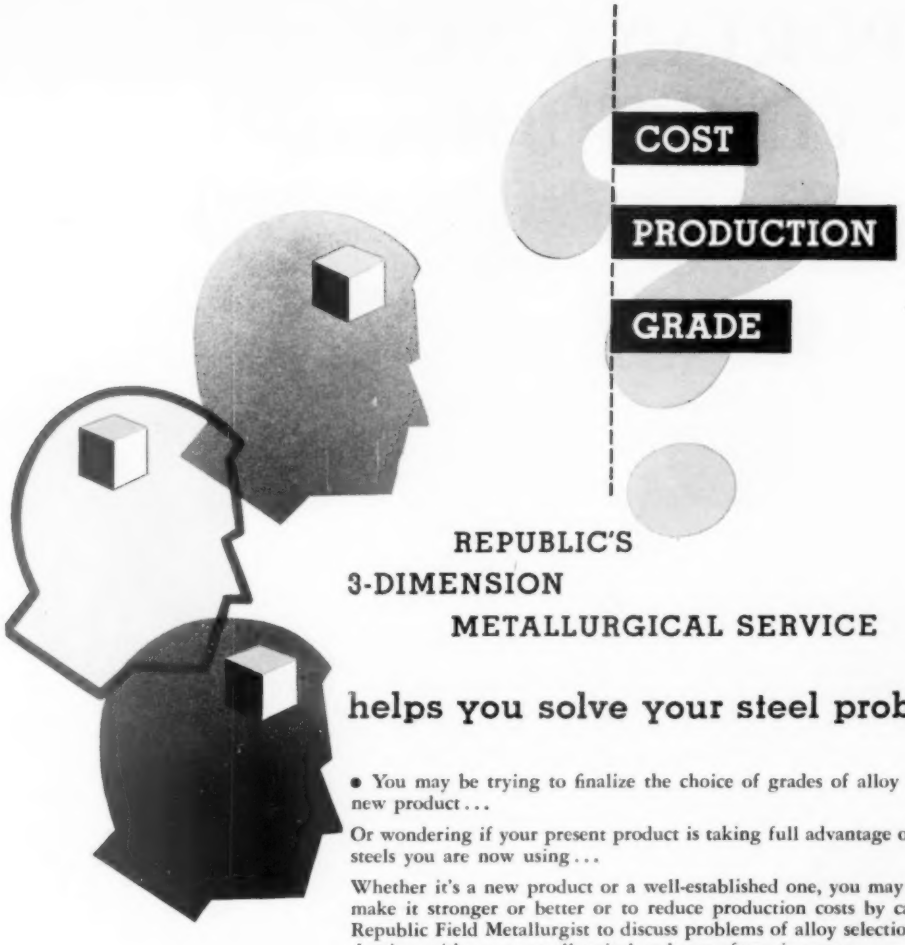
EXPORT: 405 Lexington Ave., New York, N. Y., U. S. A.



REPUBLIC'S 3-DIMENSION METALLURGICAL SERVICE

helps you solve your steel problems

• You may be trying to finalize the choice of grades of alloy steel for a new product . . .

Or wondering if your present product is taking full advantage of the alloy steels you are now using . . .

Whether it's a new product or a well-established one, you may be able to make it stronger or better or to reduce production costs by calling in a Republic Field Metallurgist to discuss problems of alloy selection and production with your metallurgical and manufacturing men.

The Republic Field Metallurgist is backed-up in his recommendations to you by a Republic Mill Metallurgist and a Republic Laboratory Metallurgist. Together they offer a complete and extensive consulting service to steel users . . . Republic 3-Dimension Metallurgical Service. Available to you through your local Republic Steel sales office.

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LAB FIELD MILL
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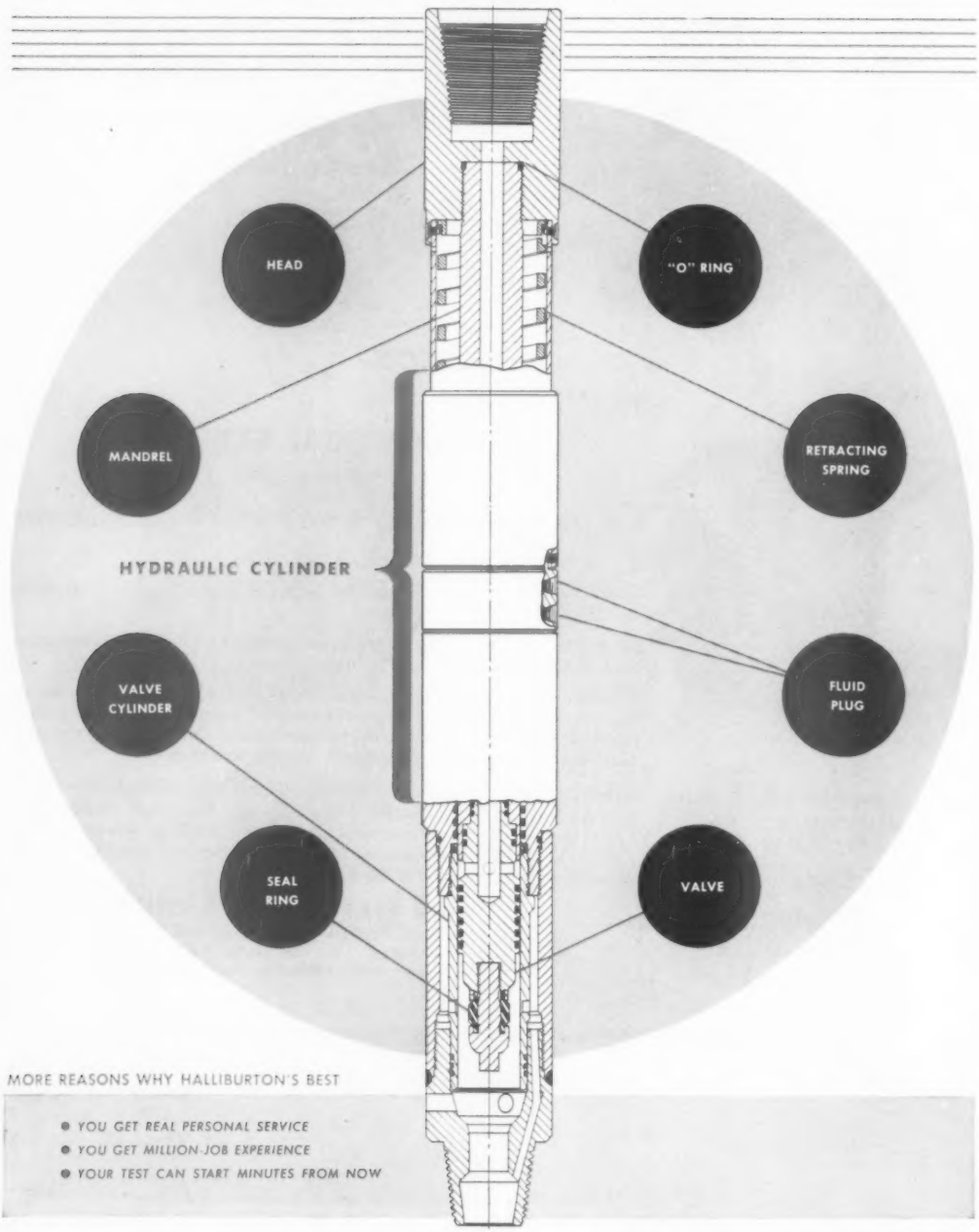
. . . combines the extensive experience and coordinated abilities of Republic's *Field*, *Mill* and *Laboratory* Metallurgists with the knowledge and skills of your own engineers. It has helped guide users of Alloy Steels in countless industries to the correct steel and its most efficient usage. IT CAN DO THE SAME FOR YOU.

Republic ALLOY STEELS

REPUBLIC STEEL

Other Republic Products include Carbon and Stainless Steels—Sheets, Strip, Plates, Pipe, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing

IMPORTANT NEW TESTING TOOL...



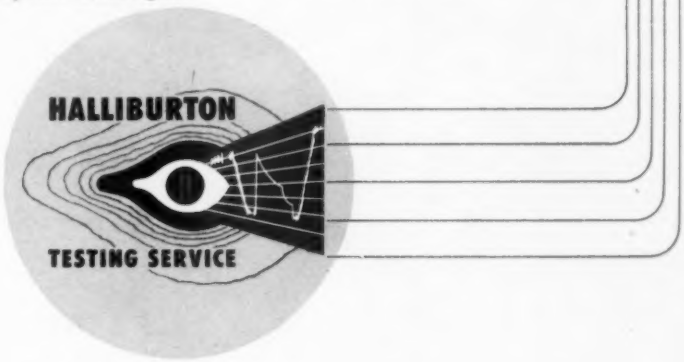
MORE REASONS WHY HALLIBURTON'S BEST

- *YOU GET REAL PERSONAL SERVICE*
- *YOU GET MILLION-JOB EXPERIENCE*
- *YOUR TEST CAN START MINUTES FROM NOW*

HALLIBURTON'S
HYDROSPRING TESTER

- ***Performed Perfect Test On Over 1,000 Field Trials***
- ***No Previous Development Promises So Much To Successful Testing!***

More than ever, now, is Halliburton best for your drill stem test. Big new reason is the Hydrospring Tester. This tool was not only trouble-free and fool-proof in over 1,000 field trials, but proved to offer many new advantages:



- **It's a combination tool requiring fewer assemblies.**
- **It can be run in faster, reaches bottom easier.**
- **Opens easily and positively by weight of drill pipe — eliminates rotating, dropping of bar, turning of J-slots.**
- **It gives positive indication at surface that tool is open.**
- **It permits reversing off bottom simultaneously with taking closed in pressure.**
- **It can be rotated coming out of hole.**

You'll hear a lot of good things about Halliburton's new Hydrospring Tester. No previous development promises so much . . . it's the miracle of modern testing. Once again is Halliburton's leadership proved . . . once again big research and million job experience pay out with improved testing service.

Get all the new advantages offered by the Hydrospring Tester on *your* next test. Phone your nearby Halliburton Testing Specialist. Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

YEARS AHEAD IN DRILL STEM TESTING!

Close Inspection

This cat picture makes us think of the final inspection of Midwest Welding Fittings. It is equally intense, searching, eye-on-the-ball type. Such final inspection is only one of an exhaustive series of continuous controls and checks that play an important part in assuring the high quality and uniformity of all Midwest Welding Fittings. You can cut your welded piping costs by specifying Midwest Welding Fittings.

A corner of the Final Inspection Department where every Midwest fitting is individually checked for concentricity, uniformity, and dimensional accuracy. Such checks are the last of a series conducted during production.

MIDWEST PIPING COMPANY, INC.
(Formerly Midwest Piping & Supply Co., Inc.)
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Passaic, Los Angeles and Boston
Sales Offices: New York 7—50 Church St. • Chicago 3—79 West Monroe St.
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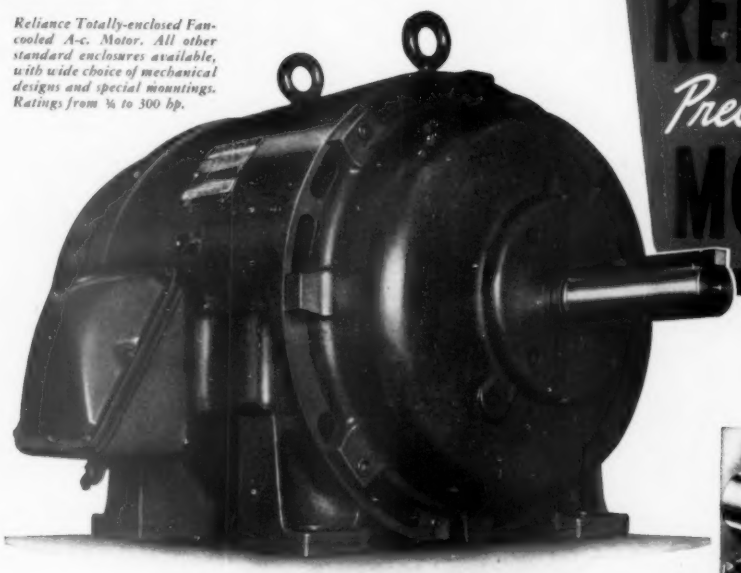
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

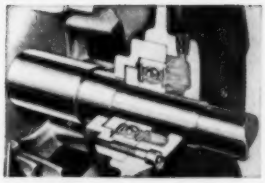
MIDWEST WELDING FITTINGS

610

DEPENDABLE...because they're ENGINEERED FOR OIL-WELL PUMPING

Reliance Totally-enclosed Fan-cooled A-c. Motor. All other standard enclosures available, with wide choice of mechanical designs and special mountings. Ratings from ½ to 300 hp.





☆ Heavy shafts, bearing to bearing.

☆ Indestructible pressure-cast rotors.

☆ Shock-resistant frame and bearing-bracket construction.

See the RELIANCE MOBILE DISPLAY UNIT at the PETROLEUM EXPOSITION Tulsa, May 14-23, 1953

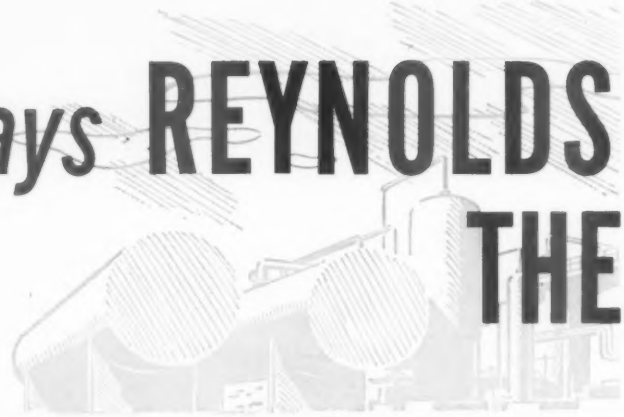
WHY THE RELIANCE PRE-LUBRICATED BEARING DESIGN IS BEST

The Reliance pre-lubricated bearing provides *four times more operating hours without re-lubrication* than any other bearing used in motors today. And—whatever your lubrication schedule—*you just can't grease 'em wrong!* To get the complete "inside story" on motor bearings, write today for Bulletin B-2201. It contains hard facts on the advantages of the Reliance pre-lubricated bearing design, with cutaway view, cross-section diagram, comparison chart, and statements by bearing manufacturers. B-1402

RELIANCE ELECTRIC AND ENGINEERING CO.

1120 Ivanhoe Road, Cleveland 10, Ohio • *Sales Representatives in Principal Cities*

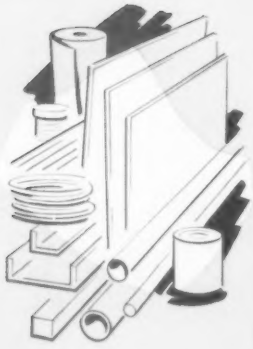
4 ways REYNOLDS THE



1 Specialized Consulting Service

Rely on Reynolds for help in the solution of your problems involving corrosion, processing chemicals, construction and shipping containers. The staff of each Reynolds regional office includes a chemical engineer as well as specialists in the other phases of engineering. When further consultation is necessary, a fully integrated technical staff at the main office in Louisville is ready to show you how to save time, money and labor with Reynolds chemicals, mill products and aluminum shipping drums.

3 Aluminum Mill Products



Tubing for Heat Exchangers, including condensers. Aluminum offers high heat transfer and corrosion resistance with low initial, shipping and handling costs.

Tubing for Instrument Lines. While less costly than other nonferrous tubing, lighter weight aluminum is comparable in mechanical characteristics and resistance to corrosion.

Pipe for Field and Process Applications. Aluminum pipe resists corrosion, has smooth innner surfaces and is non-sparking . . . plus being lightweight for handling and installation structural support economies.

Flat and Coiled Sheet for Bulk Insulation Jacketing. Lasting appearance, easy application and added insulation are provided by aluminum.

Sheet and Plate. For process vessels, trays and bubble caps, storage tanks, and building applications aluminum has many advantages. Its non-sparking characteristic is important around highly volatile products.

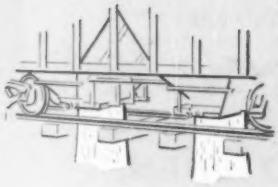
Structurals, Rod and Bar are ideal for lightweight piping supports, framework, ladders and scaffolding.

Electrical Conductor for uses including transmission and distribution lines and bus conductors. Lightweight aluminum is easy to handle and has a distinct price advantage.

Powders and Pastes for heavy explosives, pyrotechnics, thermite reactions, aerated concrete and pigment for plastics and paints.

SERVES PETROLEUM INDUSTRY

2. Basic Aluminum Chemicals



Organic-free Aluminum Trihydrate. Chalk up another first for Reynolds with this product. It is a brand-new premium quality chemical selling at a standard commercial price. It is naturally snow-white . . . and purer than any other similar product now available. Standard commercial and low iron hydrates are also available.

Metallurgical Alumina. This high-grade product, for use in refractories, abrasives, ceramics and glass, is available in all standard commercial grades.

4. Benson Aluminum Drums

Thanks to non-rusting aluminum, these superior quality shipping containers cut replacement costs . . . reduce handling and maintenance charges . . . slash shipping costs . . . and protect against the spoilage and contamination of chemicals.

Five basic types of drums are available, with modification for each requirement. One of them is especially designed to solve your shipping problem. Consult the Reynolds office nearest you for full information or write for a brochure to Reynolds Metals Co., 2595 S. Third St., Louisville 1, Ky.

Available to you without cost

REYNOLDS TECHNICAL HANDBOOKS

Each book is an authoritative reference on a single aspect of aluminum design or fabrication. They are yours on request. Write or call for a complete list of Reynolds technical literature and movies.

Be sure to see "Mister Peepers" every Sunday night, 7:30 EST, NBC-TV; hear "Fibber McGee and Molly" every Tuesday night, 9:30 EST & PST, NBC

REYNOLDS CHEMICALS

FROM THE PRODUCERS OF REYNOLDS ALUMINUM

You can

Hang your hat

on the specifications of

PITT CHEM *MODIFIED* Pipeline Enamel

YOU don't have to guess about the uniform top quality of *Pitt Chem* Modified Enamel. Look at its written specifications—check its softening point, penetration, ash, etc.—and you'll know the rigid standards each drum *must* meet. Then watch a pipeline crew roll when they're coating with *Pitt Chem*, and you'll know that these enamels actually do heat up faster, flow better from kettle to pipe and coat more pipe per day.

Pitt Chem's *specified* top quality means better protection underground, too, for it allows a better bond and greater resistance to soil stresses and varying service temperatures. ● Write today for *Pitt Chem* specification sheets . . . or any help you may need on your particular coating problem.

- ★ Standard Grade Tar Base Enamel
- ★ Modified Grade Tar Base Enamel
- ★ Plasticized Grade Tar Base Enamel
- ★ Cold Applied Tar Base Coatings

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Although steel pipe may look pretty much alike when it's piled up in racks, it's a different matter when it comes to performance. Then there's one *sure* choice for dependable, long life service—SPANG "CW" Steel Pipe.

Thousands of oilfield men know about the special manufacturing and metallurgical controls used in the manufacture of SPANG Oilfield Tubular Products . . . and it's the same with SPANG "CW," a high quality pipe for oilfield service.

On hundreds of piping jobs—for water systems, oil-gathering systems or gas lines, salt water disposal, air, or water flooding lines—SPANG "CW" means a quick installation, and exceptional service life. Add to this such other SPANG "CW" features as high bursting strength and superior workability—and you know why SPANG "CW" is profitably different.

On your next piping job, why not enjoy the plus benefits of SPANG "CW" at no extra cost—a complete range of standard sizes is normally available through your nearby National Supply Store.

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THE NATIONAL SUPPLY COMPANY

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SPANG STEEL PIPE • SUPERIOR & ATLAS ENGINES

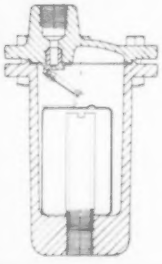
NATIONAL BLUE PRODUCTS

ARMSTRONG *Forged Steel* TRAPS FOR ALL PRESSURES

1. High Shock Resistance.
2. Bodies Will Withstand Fire.
3. The Cost Is Low.

No. 3211 — ONLY $20.00 LIST

Right—Here's the baby of the Armstrong forged steel line, a low priced trap for working pressures up to 250 psi—design pressures, 450 psi. Capacity range 750 to 1000 lbs/hr continuous. Diameter 4¼", height 7", weight 8 lbs. Available with ½" or ¾" connections. Standard Armstrong interior mechanism. Here's forged steel safety for only a few dollars more than a cast iron trap! Available for shipment from stock. Write today.



Cross-section of an Armstrong No. 3211 forged steel trap. Forged cap and body. Compressed graphited asbestos gasket. All stainless mechanism. This trap will take high temperatures and abuse without danger of fracture.

MORE and more refineries and natural Gasoline plants are using ARMSTRONG FORGED STEEL TRAPS, even at pressures as low as a few pounds. The extra safety in case of fire or an explosion more than justifies the moderate additional cost.

To use cast iron or semi-steel traps puts a weak link in the chain of steel pipe, steel fittings and steel valves. The shock of a distant explosion could fracture the cast iron traps.

Why take a chance when Armstrong forged steel traps cost so little more than cast iron?

A "standard" in high pressure power plants throughout the world, Armstrong forged steel traps are the perfect answer for extra safety and dependability in the petroleum industry. Prices are modest. For complete data, send for your copy of the ARMSTRONG STEAM TRAP BOOK.

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See Armstrong at the Oil Show—Booth 32, Texas Bldg.

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RIGHT AT THE BEGINNING—

Plan on using Bitumastic® Enamel to protect your pipe line against corrosion

ANY pipe line, whether large or small, is an important investment — an investment that should be properly protected.

That's why it's wise, when planning a new pipe line, to include Bitumastic Enamel in your designs, plans and specifications. Bitumastic Enamels, manufactured from selected coal-tars have proved they can prevent corrosion. Many oil and gas pipe lines, that were coated with Bitumastic Enamel and laid 20 and 30 years ago, are still giving good service today.

Why not let your Koppers representative work with you from right at the beginning through final operations? He will be glad to assist you in getting the most out of your protection dollar. Write for full information.

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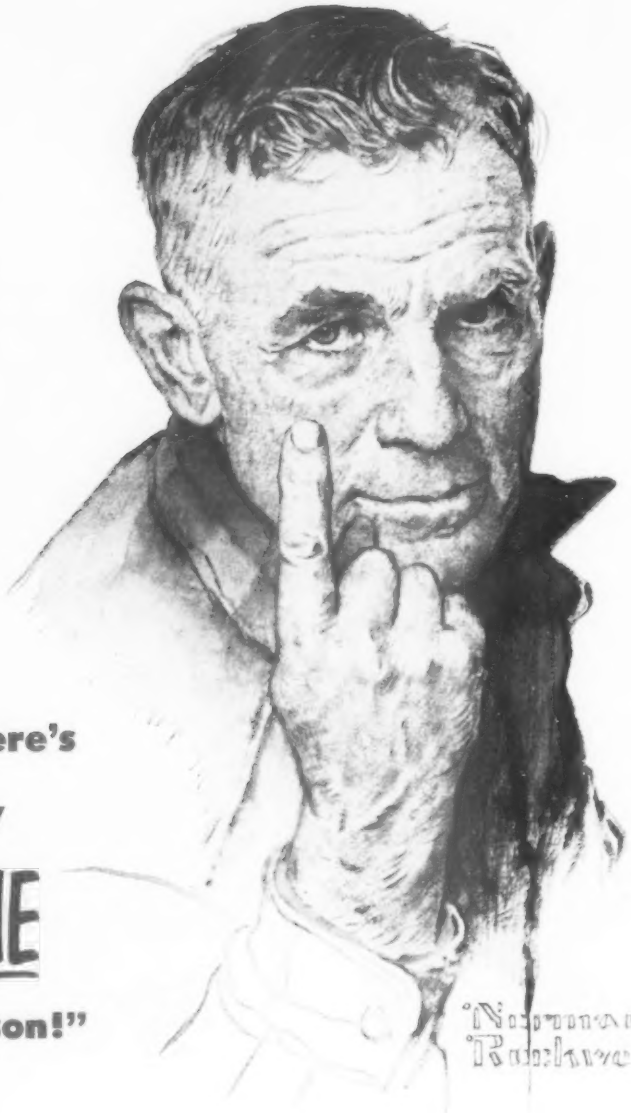

"There's only ONE reason!"

IT'S JUST THAT SIMPLE. There's only one reason in the world why 2 out of 3 wire rope users in the oil fields prefer Roebling wire rope ... *it costs less on the job than any other.*

For maximum wire rope efficiency and economy, call your nearest Roebling office for a Field Man. He'll recommend the best ropes for your operations ... District Offices at Cleveland, Denver, Houston, Los Angeles, Odessa, Tulsa.

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THE NATIONAL SUPPLY COMPANY • REPUBLIC SUPPLY COMPANY

New— Revolutionary AIR SPRING

The GENERAL AIR SPRING in various sizes is now available to all vehicle and suspension manufacturers for design into complete suspensions and for conversions on both single and tandem axles.

AIR IS YOUR ANSWER TO LOWER COSTS

★ INCREASES PAYLOAD

The General Air Spring permits a savings of approximately 300 pounds more than the average steel suspensions. This allows up to *300 pounds more payload.*

★ INCREASES SAFETY

The General Air Spring assures positive braking action. Equal axle loading is maintained while brakes are applied, giving maximum brake effectiveness. No chatter, hop or bounce . . . loaded or empty.

Automatic air pressure control keeps body parallel to axles eliminating heeling over due to misloading, shifting loads or high crown roads.

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Automatically measured air pressure fits every load condition from maximum to empty. This results in proper riding deflection, maximum spring efficiency.

Bottoming of springs with resulting strain on axles and frame is eliminated.

The absorption of road shocks and high frequency vibration reduces metal fatigue in frame and body.

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★ REDUCES OPERATING COSTS

Controlled, easy ride and positive braking action reduces bounces, excess deflection and skidding. Results in more tire carcass life and slower, even tread wear.

Controlled ride reduces cargo breakage. Eliminates high frequency vibration and reduces damage to perishable goods.

THE GENERAL AIR SPRING

● *For information write: Air Spring Division*

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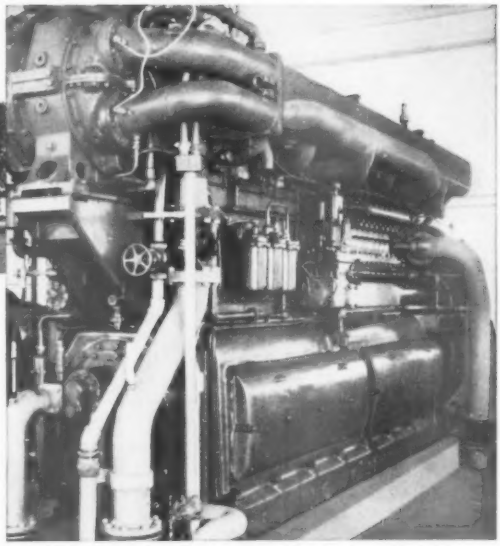
SPECIFY GENERAL AIR SPRINGS ON YOUR NEW EQUIPMENT

165,000 hours of service completed by 28 Alco Diesels at 98½% availability

for Gulf Refining Company



Twenty-two years ago, Gulf Refining Company installed 28 Alco Diesel Engines on its new, 700-mile Tulsa-to-Spencerville Junction pipeline. Today, those 28 Alco Diesels have completed more than 165,000 hours of service and are operating at 98½% availability. And since 1941, when the output of the line was greatly increased, they have been in actual service an average of 97% of the time.

Pumping station superintendents throughout the United States and Canada specify Alco Standardized Diesels because of this kind of *proved* dependability——and because of these economy features:

- **Compactness**—for lower construction costs
- **Higher Engine Efficiency**—for lower fuel costs
- **Medium Speed**—for lower auxiliary equipment costs
- **Flexible Power Range**—for lower expansion costs

For the complete story on Alco Diesel Engines, contact your nearest American Locomotive Company Sales Office. You will find them in New York, Beaumont, Chicago, Cleveland, Houston, Kansas City, San Francisco, Schenectady and St. Louis.

ALCO DIESELS

THE MARK OF MODERN ENGINEERING

AMERICAN LOCOMOTIVE COMPANY

The Twins can handle ALL your Bridging Plug Jobs!

What are your needs?

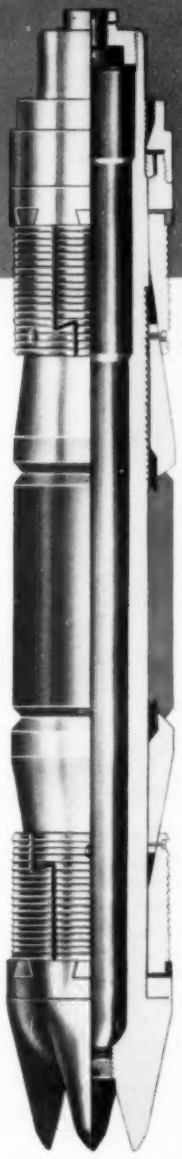
POSITIVE SETTING? The set position view, lower right, shows how the broad, opposed slips set the plug right where you want it — and *hold* it there against pressures either up or down.

LEAK-PROOF PACKOFF? Notice, in the set view, how the extra-large packing element, confined top and bottom against "flow" in either direction, gives permanent packoff.

HIGH PRESSURE RESISTANCE? Cast iron Lane-Wells Bridging Plugs have performed successfully against pressures up to 10,000 p.s.i. — magnesium Lane-Wells Plugs are rated up to 6,000 p.s.i.

FAST DRILL OUT? Both cast iron and magnesium models are drilled out or knocked down in quick time, with either rotary or cable tools . . . magnesium in 1 to 3 hours, cast iron in 4 to 6 hours.

PERMANENCE? Lane-Wells cast iron Bridging Plugs will outlast the casing in permanent installations such as false bottoms or abandonments.



LEFT: This cutaway view shows the simple, sturdy construction of all Lane-Wells Drillable Bridging Plugs.

BELOW: This view of a Lane-Wells Bridging Plug in set position shows how it gives positive setting and leak-proof packoff.

LANE WELLS COMPANY

Drillable Bridging Plugs

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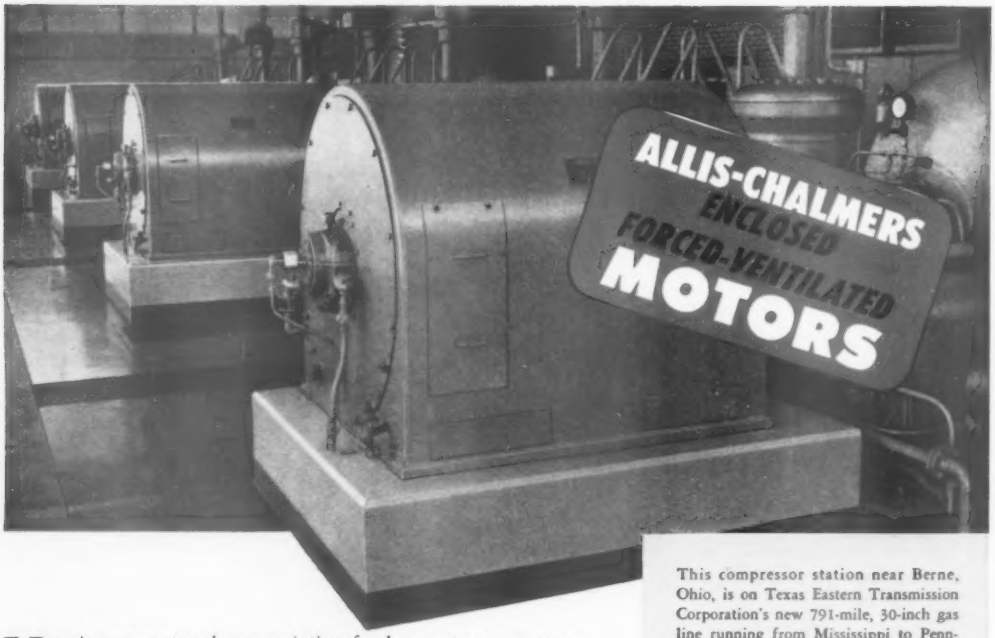
★ ★ ★ ★ ★ for Pipe-Line Stations

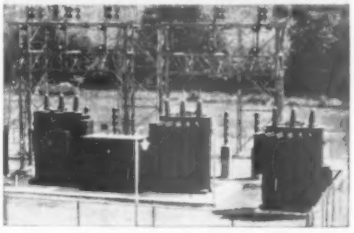


This compressor station near Berne, Ohio, is on Texas Eastern Transmission Corporation's new 791-mile, 30-inch gas line running from Mississippi to Pennsylvania. The four Allis-Chalmers forced-ventilated cage motors shown are rated 2500 hp, 3600 rpm each. A-C also supplied the unit substation shown below.

HERE'S an easy-to-take prescription for low-cost compressor or pump drives: Start with Allis-Chalmers enclosed forced-ventilated motors . . . then add a common ventilating system. That's all there is to it, but you get these five advantages:

- ★ The motors cost little more than open motors.
- ★ They need scarcely any attention because they operate in cool, clean air. (And the heated air can be discharged outside the motor room in summer and used for heating in winter.)
- ★ Protection for these hazardous locations is provided by supplying the ventilating air under pressure — during starting and during operation.
- ★ The motors are designed for the installation. They can, for example, be built for foundation, side or top air ducts.
- ★ Motor details are designed for easy installation and maintenance . . . plus longevity: Capsule-type housings permit access to motor interior without exposing bearings. Dual oil rings provide uniform, uninterrupted lubrication. Supplementary forced-feed oiling system on 3600-rpm motors is self-contained and air-cooled.

A-3879



Your A-C representative can help you decide where to use these modern pipe-line motors. Allis-Chalmers, Milwaukee 1, Wis.

ALLIS-CHALMERS A-C

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plus!

Skilled design engineers demand superior products for their customers' use. And well they might! A.C.F. has the equipment, the techniques and the resources to shoulder a major responsibility, and deliver the goods. The shops are tooled for hand and machine-welding under precision control, for X-ray inspection as required, and with the personal skills and experience of as expert a staff as exists anywhere. We'd be delighted to discuss adding your firm name to the customer list. Write for literature.

Installation for this New York utility by H. Emerson Thomas and Associates, Inc., of Westfield, New Jersey.

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All SHELL AND TUBE ...HEAT EXCHANGERS by Vogt

ABOVE: View of new construction at Louisville Refining Company.

BELOW: Some of the many Shell and Tube Exchangers.

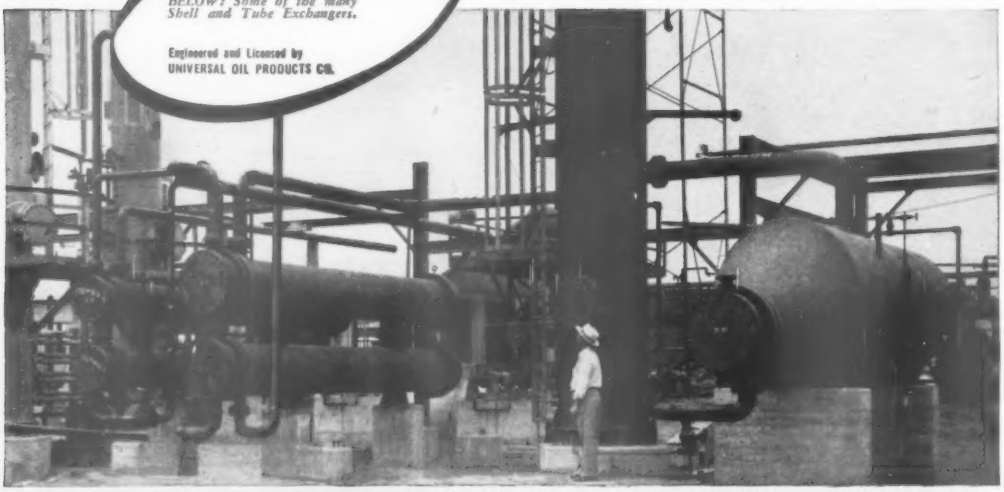
Engineered and Licensed by UNIVERSAL OIL PRODUCTS CO.

At LOUISVILLE REFINING CO.'S New CATALYTIC CRACKING PLANT

Premium gasoline production has been boosted 20% from the same amount of oil charged since the Louisville Refining Company's new Catalytic Cracking Plant went on stream.

The new plant uses Vogt Shell and Tube Heat Exchangers exclusively and they make a significant contribution to the efficient and economic operations of this progressively modern refinery. Vogt Shell and Tube Heat Exchangers are available in many different types, with fixed or removable tube bundles, to meet the special problem and specific operating conditions of each installation. They are constructed from carbon and special steels to meet every temperature, pressure, or vacuum service requirement.

WRITE FOR BULLETIN HE-6



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can you use this new Roller Chain?

Maybe you can use the Improved Baldwin Assembly Multiple Width Riveted Roller Chain... IF you want to save money...save costly down time...speed up chain assembly and repair in the supply store and in the field...simplify chain inventory and stocking!

It's not particularly sensational...just the handiest, most usable riveted roller chain yet! Here's all there is to it. It's just a ten-foot strand riveted multiple width chain with exclusive Single Pin Couplers installed at convenient intervals in the strand, so that any length of chain may be made up in a hurry without cutting the chain or damaging chain parts. It's just as easy to couple and uncouple as cottered chain. BUT the entire strand retains the added life of riveted chains. You can install these chains in a hurry and save plenty by cutting "down time." Chain is shipped in boxes with a ten-foot assembled length in each box. Or, it can be *made up* in any length you specify. Why not send for the complete story? Just mail the coupon.

HERE IT IS: One end of the single pin coupler link is firmly riveted to the adjacent link (1). The unique coupler pin (2) has a spun washer (3) on one end, the other has a milled flat (4) and locking pin. The pin is an easy fit through the chain except for the milled flat end which is press-fitted into a special matching hole (5) of the single pin coupler plate. You need only drive the pin the length of its milled flat in assembling or disassembling the chain. It's easy . . . saves time, effort and money.

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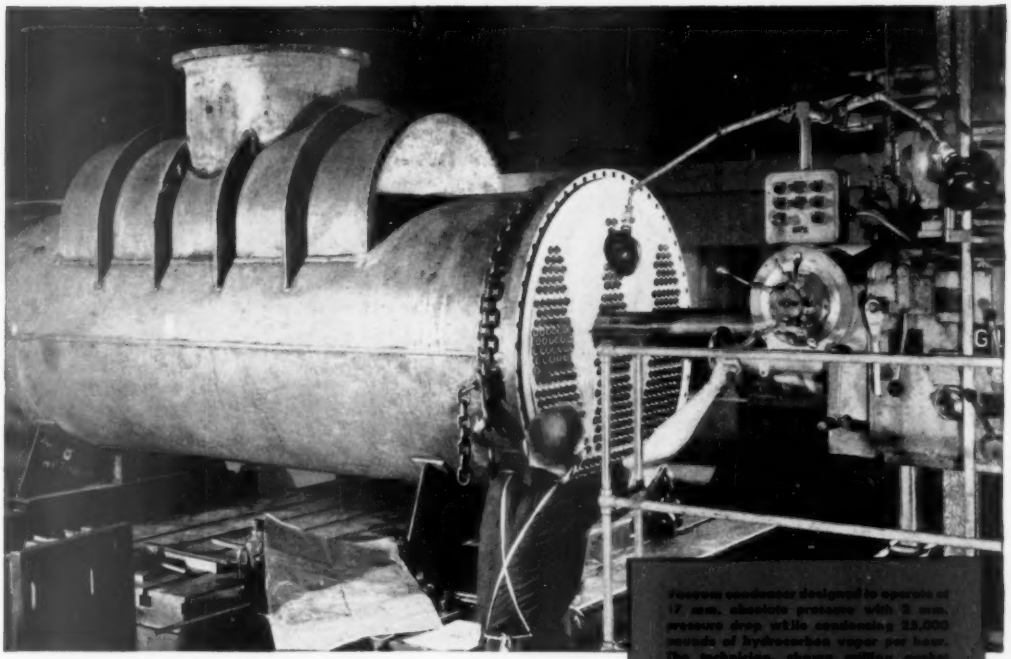

Vacuum condenser designed to operate at 17 mm. absolute pressure with 2 mm. pressure drop while condensing 25,000 pounds of hydrocarbon vapor per hour. The technician, shown milling gasket grooves in the tube sheet, has been with A. O. Smith continuously since 1931.

SPECIAL Heat Exchangers

FOR CUSTOMERS' PROCESS REQUIREMENTS

Shown nearing completion is the A. O. Smith solution to one of its customer's heat exchanger problems. Starting with only the process conditions, the condenser was designed and manufactured in its entirety by A. O. Smith.

Successful design of the exchanger to meet critical process requirements necessitated a special tube arrangement to provide minimum pressure drop, and inlet nozzles to give maximum distribution of vapors throughout the entire length of the condenser.

For the design and manufacture of special equipment to solve special process conditions, like the above, A.O. Smith has a corps of experienced research, engineering and manufacturing groups. For over 25 years they have been serving the petroleum and chemical industries, accumulating invaluable experience, data and skills which *YOU* may depend on to help solve *YOUR* heat exchanger and vessel problems.

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WITH HEAT EXCHANGER PROBLEMS

Mobilgas Milestones

Catalytic Cracking

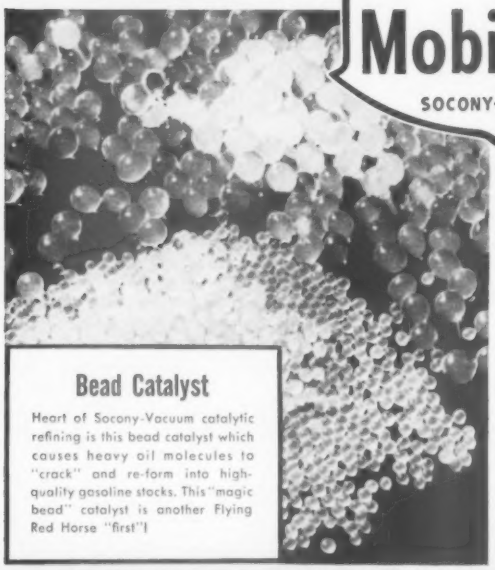
Secret of today's improved car engine design and performance is the super-high-power gasoline ingredients made available through catalytic cracking. Socony-Vacuum built the first commercial "cat cracker" in 1936!

TCC Refining

In 1943 the first commercial Thermofor Catalytic Cracking unit — using a continuous catalytic process — went into production. Created by Flying Red Horse research, this TCC process made possible greater quantities of high octane stocks and even better gasolines!

Mobilgas

SOCONY-VACUUM



Bead Catalyst

Heart of Socony-Vacuum catalytic refining is this bead catalyst which causes heavy oil molecules to "crack" and re-form into high-quality gasoline stocks. This "magic bead" catalyst is another Flying Red Horse "first"!

New Reforming Process

TCR — Thermal Catalytic Reforming Process — latest in catalytic processing — produces highest-quality blending stocks from low-quality material . . . assuring continued Flying Red Horse leadership!

SOCONY-VACUUM OIL COMPANY, INC.

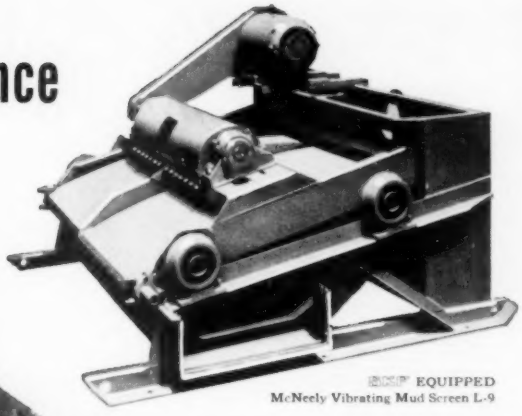
and Affiliates:

MAGNOLIA PETROLEUM COMPANY · GENERAL PETROLEUM CORPORATION

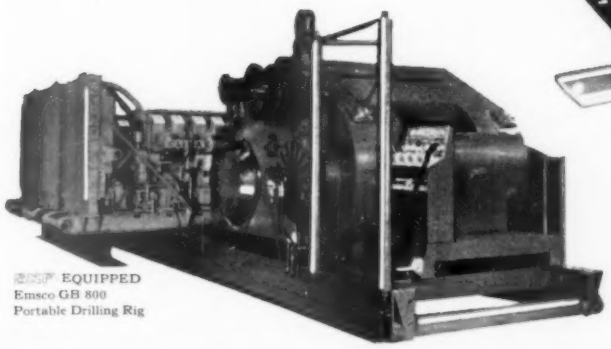
SOCONY-VACUUM

PREFERRED FOR performance

PREFERRED FOR service

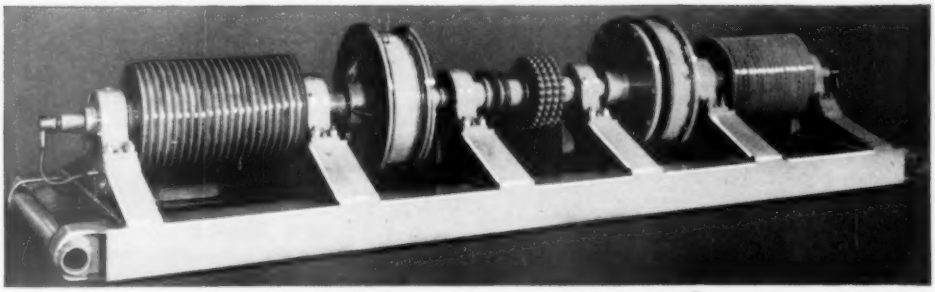


SKF EQUIPPED
McNeely Vibrating Mud Screen L-9



SKF EQUIPPED
Emsco GB 800
Portable Drilling Rig

SKF EQUIPPED
A & M Double Pump Drive



Throughout America's oil fields—in drilling rigs, draw works, wherever *tough* jobs get done—SKF Spherical Roller Bearings are preferred.

For a typical application—the vibrating shaft of the McNeely Vibrating Mud Screen is mounted on two SKF Spherical Roller Bearings. Here, the bearings stand up under real brute punishment, a major factor in the L-9's smooth, dependable operation.

In Emsco's GB-800, SKF Spherical Roller Bearings are used on all shafts throughout the draw works, effectively minimizing maintenance and downtime.

The specially designed A & M Double Pump Drive shortens the length of belts to mud pump, results in an approximate saving of 50% in belt costs. Here again, SKF bearings are doing an outstanding job.

For hardworking oil field applications, you can rely upon the *performance* of SKF Bearings, the *service* of SKF Engineers, the *dependability* of SKF Distributors. Consult SKF today! 7408

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.
—*manufacturers of* **SKF** *and* HESS-BRIGHT *bearings.*

SKF®
BALL AND ROLLER BEARINGS

LOOKING FOR SERVICE?

THEN LOOK TO IVERSON

The men who staff IVERSON Stores have had years of experience in assisting drilling and production men in solving their problems. Maybe you have run into a situation that you don't know how to solve. Maybe your IVERSON Supply man has helped solve the same problem before and has the answers. It will pay you to get acquainted with your IVERSON Store Personnel. You will find them always available.

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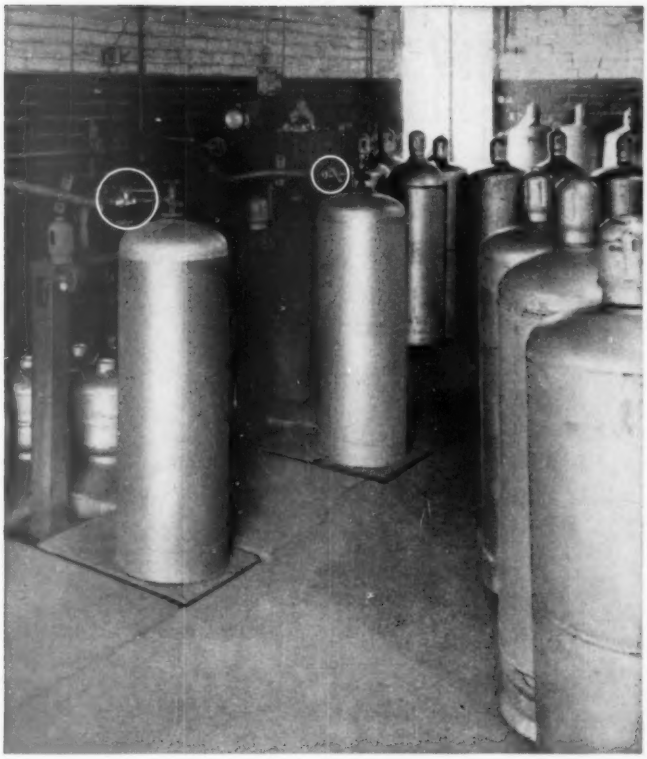
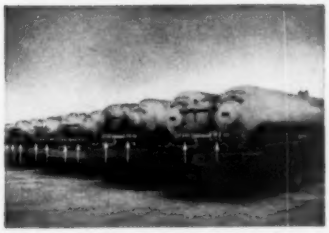
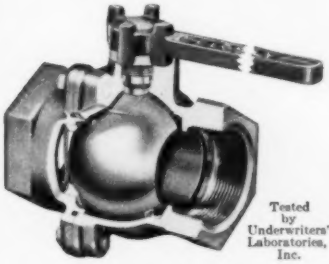




Safest, too! Because of their leakproof construction, Rockwood Ball Valves were selected as safest for handling inflammable gases on the Texas Transport Company's fleet of propane-butane trucks.



Tested by Underwriters' Laboratories, Inc.

Big propane plant reports:

"Increased production and no maintenance"

with these amazing new ball valves

One of many enthusiastic users of Rockwood Ball Valves, this large propane plant ships up to 400 tanks of bottled gas daily to householders. Valves are operated every two minutes during the day. The plant supervisor states their extra fast opening and closing, full *round* flow and tight seal makes them real production boosters and cost cutters . . . *and they need absolutely no maintenance!*

ROCKWOOD *FULL-FLOW* BALL VALVES

THE FLOW IS AS ROUND AS THE PIPE ITSELF

4 BIG FEATURES FOR TOP PERFORMANCE

Full Round Flow . . . no change in shape or volume of the fluid stream . . . no turbulence . . . minimum friction loss.

Quick Opening And Closing . . . needs only a quarter turn, even under full pressure.

Resists Wear Longer . . . scratching, pitting and abrasion have little effect on the chrome-plated, floating bronze ball.

Stays Leakproof . . . in closed position, pressure of fluid automatically positions ball against synthetic rubber seat to form a tight seal.

Get the whole story of how this outstanding Rockwood development gives you more of what you want in valve performance. Mail the coupon today.

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Send me illustrated folder V-4 on Rockwood Full-Flow Ball Valves.

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MADE TO MEASURE

GAS ENGINE LOADS

HEATING LOADS

BOILER LOADS

ROCKWELL "800" METER

with ALUMINUM ALLOY CASE

ONE MAN CAN INSTALL

Weighs only 63 lb.

Capacity 800 cfh
(at ½" diff. of 0.60 sp. gr. gas)

Working Pressure 100 psi

Connections—45 Lt. or 1½" Female Pipe Thread

Available with Drains for Removing Entrained Liquids.

Here's a mighty handy addition to the Rockwell meter line. It precisely fits the need for general oil field measurement installations. The aluminum alloy body and cover provide a surprisingly light meter that one man can install with ease. Single joint construction plus a 100 psi operating pressure rating assures a high degree of safety. The vertical dial index is standard. Type I Emcorectors or Combined Record gauges can also be mounted on these new Rockwell 800 meters. Write for full details.

You Can RELY ON ROCKWELL

ROCKWELL MANUFACTURING COMPANY

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HERE'S WHY EMSCO PUMPING UNITS REDUCE PUMPING COSTS

Illustrated here are three important features of Emsco Pumping Units that contribute to their economy of operation.

In addition, you get: 1) Controlled splash lubrication of all gears and gear box shaft bearings. 2) Rigid, one-piece gear box—there is no split across bearing bores. This eliminates danger of bearing distortion. 3) Roller bearings throughout. 4) Four-legged, derrick-type samson posts with widely spaced, rigidly braced legs.

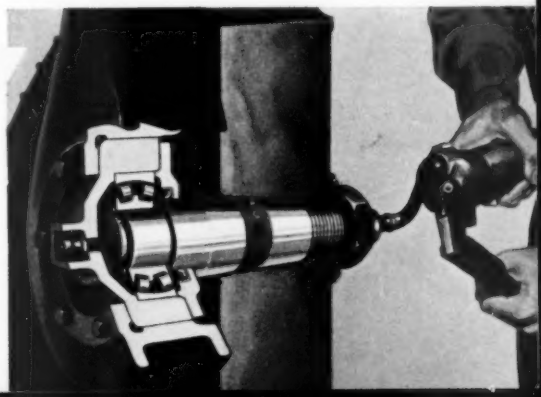
Then, too, Emsco Pumping Units are packaged as a unit, shipped as a unit and stored as a unit to avoid lost time and delays at the well site.

Call CONTINENTAL for the pumping unit that will meet your pumping requirements.

Working at ground level, one man can safely, quickly and accurately adjust Emsco's patented counterweights, even on the largest units. There's no cranking, prying or lifting.

Emsco's wing-type counterweights are designed so auxiliary weights may be added as needed to meet the counterbalance requirements resulting from changing conditions in the well.

Hydraulic pressure of a grease gun unseats the wrist pin in the new Emsco pumping units. This saves times and makes light work of a job formerly cumbersome and difficult.



EMSCO

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EMSCO MANUFACTURING COMPANY

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Representatives: Argentina, Bolivia, Brazil, Chile, Colombia, England, Ecuador, Peru, Trinidad, Uruguay, Venezuela

E136-F—Trade Magazines, 1953

See it at the I. P. E.

Balanced to give *better* performance

The balanced physical properties and strain-free internal structure of D + B alloy steel sucker rods—that assure better performance—are the result of scientific heat treating.

The full-length, electronically-controlled heat treating furnace, in which all D + B alloy steel sucker rods are normalized and drawn, is the finest of its kind in the world. It is one of few in which *true* normalizing is done.

Accurate time and temperature controls are producing sucker rods that combine greater strength, ductility and impact resistance.

Each heat of alloy steel is forged, normalized and drawn to specifications determined by D + B research engineers, based on 35 years of experience in making the industry's finest sucker rods.

Call your nearest D + B or CONTINENTAL store for service anywhere . . . any time. Sales and service facilities are available in virtually all major producing areas.

YOU CAN'T BUY A BETTER SUCKER ROD

TYPE 5 SUCKER RODS

Made of nickel molybdenum alloy steel in ⅝" to 1" sizes, Type 5 Sucker Rods are recommended for heavy duty pumping in medium corrosive wells. Pony rods are available in all diameters and in lengths from 2' to 12', inclusive.

D+B DIVISION
EMSCO MANUFACTURING COMPANY
Garland, Texas · LOS ANGELES, CALIF. · Houston, Texas

D+B
COUPLINGS AND DEEP WELL PUMPS

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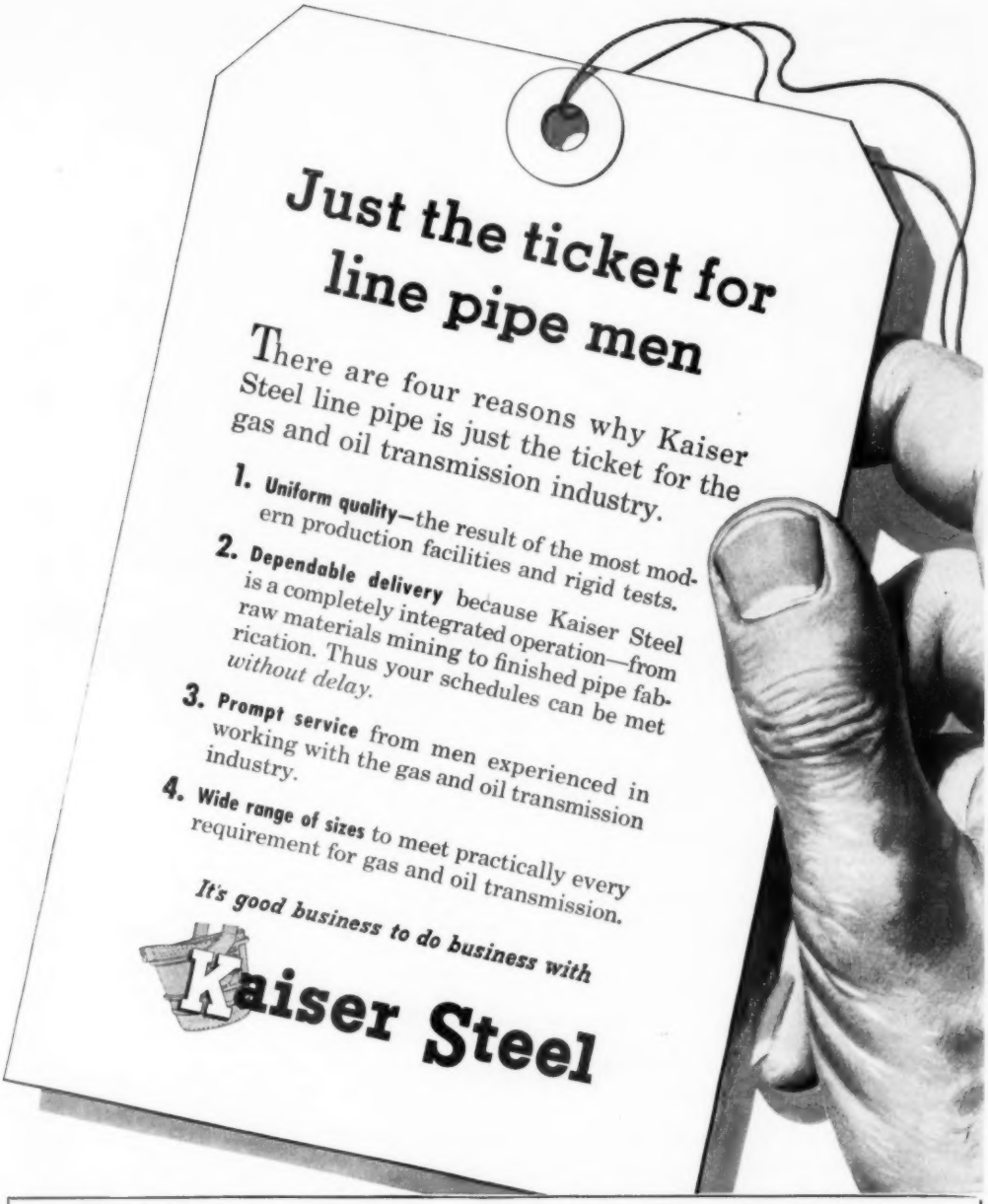

Just the ticket for line pipe men
There are four reasons why Kaiser Steel line pipe is just the ticket for the gas and oil transmission industry.
1. Uniform quality—the result of the most modern production facilities and rigid tests.
2. Dependable delivery because Kaiser Steel is a completely integrated operation—from raw materials mining to finished pipe fabrication. Thus your schedules can be met without delay.
3. Prompt service from men experienced in working with the gas and oil transmission industry.
4. Wide range of sizes to meet practically every requirement for gas and oil transmission.
It's good business to do business with
Kaiser Steel

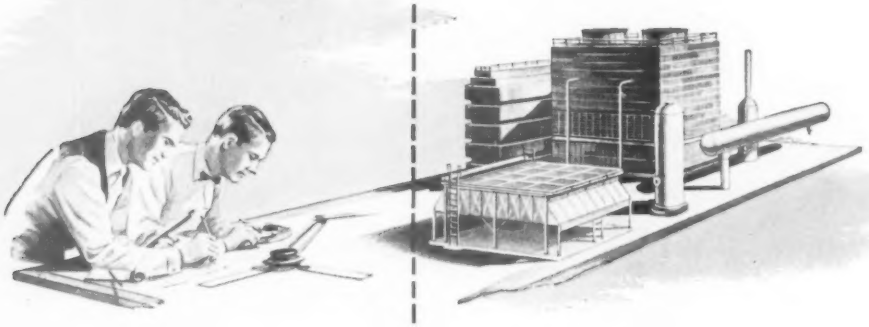
KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅛" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	22" to 30" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser

Prompt, dependable delivery at competitive prices • **KAISER STEEL CORPORATION** Los Angeles, Oakland, Seattle, Portland, Houston, Tulsa, New York

BE SURE WITH

Fluor



IN ENGINEERING AND CONSTRUCTION

Fluor's Engineering and Construction Division is a complete organization for the development of process methods, mechanical design, equipment procurement, field erection and initial operation of plants and facilities for the oil, gas-gasoline, chemical, power and allied industries.

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Fluor's manufactured products include Aerator and Counterflo Cooling Towers, Fin-Fan Air-Cooled Heat Exchangers, Pulsation Dampeners, Mufflers, Gas Cleaners and related equipment. Second to none in quality or performance, Fluor products are in service in petroleum, chemical and power installations throughout the world.

You are invited to write for complete information on any or all phases of Fluor's operations.

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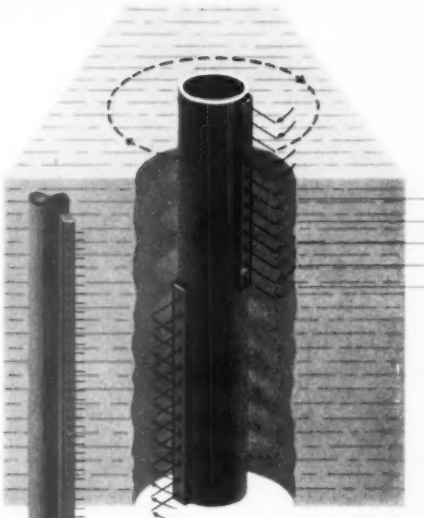
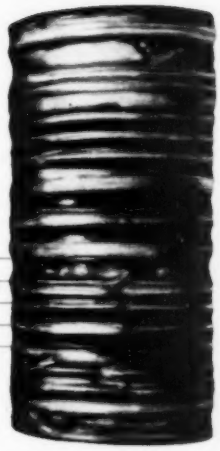
HORIZONTAL SCRAPING GIVES STRONGER CEMENT BOND...





HALLIBURTON'S ROTO WALL CLEANERS!

Get the benefits of stronger cementing through use of Halliburton's important mud-cutting tools, the Roto Wall Cleaners.

These cleaners, with their spring steel spikes of high tensile strength, cut into filter cake to create clean horizontal grooves that allow the cement to form a tighter bond between wall and casing. The laminated rings formed by the cement help prevent vertical channeling and fluid migration.

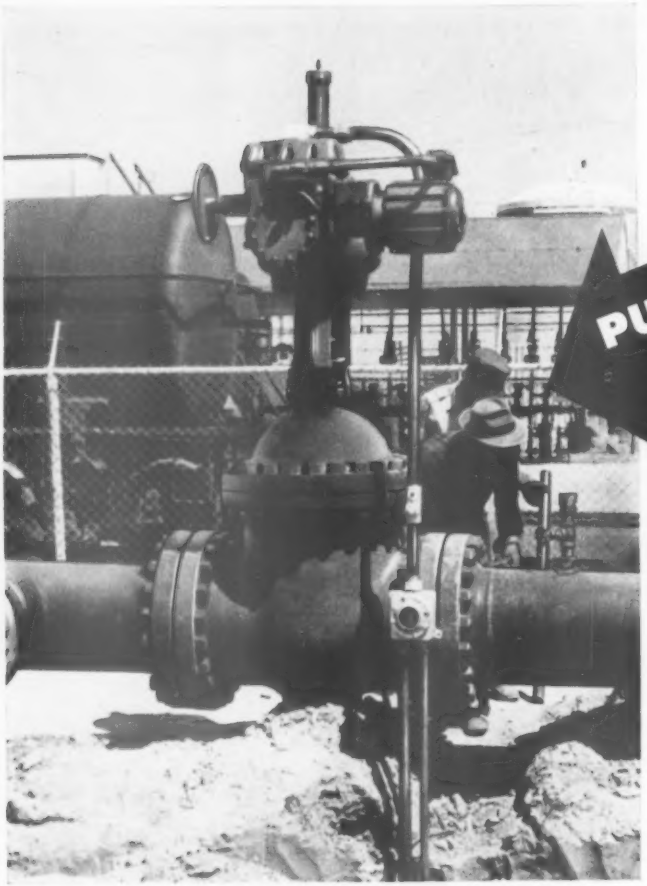
In addition, Halliburton's wall cleaners with their unique rotating action aid in centering the casing. Their scraping action permits a free flow of fluid in the annulus with no chance for bridging. And by providing a stronger, more uniform cement bond, they minimize the need for remedial squeeze jobs.

Roto Wall Cleaners come in five foot sections, each with a row of 44 spring steel spikes. Sections are tack-welded to the pipe in a staggered fashion to meet the requirements of the individual job. Rotation of the triple-coiled flexible spikes gives full action 360 degree cleaning without bending or breaking. Important, too, only one size Roto Wall Cleaner is required for all casing jobs.

Your nearby Halliburton representative has the facts on how the Roto Wall Cleaner can serve you in obtaining uniformly stronger cementing on your next job. Or contact Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

YEARS AHEAD IN
IMPROVED CEMENTING TECHNIQUES



PUT IT IN... FORGET IT!

it's a Darling pipe line gate valve

Typically, this motor-operated, 18" Darling cast steel gate valve of the fully revolving, double disc parallel seat type, is now cutting costs and maintenance on a major cross-country products line.

WHEN it's a Darling pipe line gate valve you *can* forget it—for longer than you ever thought possible! Despite extreme temperature changes, despite severe line stresses, this valve closes tight every time. It requires less maintenance. You get *surer* valve performance, year in, year out.

It's all a matter of principle—a unique but simple one—*Darling's fully revolving, double disc, parallel seat* principle! It automatically compensates for valve body distortion, equalizes disc and seat wear, cuts down-time and maintenance to the bone!

Get *all* the facts—money-saving, time-saving facts that make these Darling gate valves preferred equipment today in all kinds of oil and gas line service everywhere. Simply outline your particular service needs or ask for a complete descriptive bulletin.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

DARLING VALVES

Men who depend on power...know they can depend on CUMMINS

CUMMINS DIESELS **are engineered to make light work of tough jobs**

Why do oil field operators count on Cummins for dependable power in toughest going?

You'll find part of the answer in the special kind of versatility that belongs to Cummins Diesels alone. It's versatility that goes beyond the handling of all kinds of jobs. It's actually an ability to meet every power requirement that any situation demands . . . to save on fuel, do more work per dollar, whether the call is for continuous power or stop-and-go operation over a wide and flexible speed range.

Yes, you can count on a (60-600 h.p.) Cummins Diesel for dynamic versatility in every job — performance that stems from an exclusive fuel system and precision engineering. See your Cummins dealer for all the facts. He's a diesel specialist . . . ready to help solve your power problems.

CUMMINS

***Leaders** in rugged, lightweight high-speed diesel power!*

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402 Years of Coating and Wrapping Experience

Behind Every Job at PLS— Sparrows Point, Md.

Meet HOLLIS BATEY—
Since 1940, he has contributed his skill and experience to the service provided by PLS. He has been superintendent at Sparrows Point since 1945.

Take a staff of specialists whose combined experience totals 402 years—add the most modern facilities—and you have what it takes for the finest cleaning, priming, coating and wrapping service to be found in the industry.

That's Sparrows Point. And it's typical of the kind of protection service you can expect for your steel pipe when you put your confidence in PLS.

PLS

PIPE LINE SERVICE CORPORATION

Pioneers in Steel Pipe Protection

General Office and Plant: Franklin Park, Illinois
Plants at Glenwillard, Penna.; Longview, Texas; Corpus Christi, Texas; Harvey, La.; Sparrows Point, Md.

Dependable Service Since 1931

They Say—

Oil Needs Depend on Strategy

"If we anticipated a purely defensive war fought at the borders of the United States, indigenous and nearby supplies of our own may be the only ones available to us, but by the same token much less oil would be required than in an overseas war.

"On the other hand, if we were engaged in a conflict fought overseas, and with us or our allies controlling the seas as in World War I and II, then it is obvious that overseas supplies of essential materials could be much more valuable and helpful than purely indigenous supplies."

B. Brewster Jennings, president, Socony-Vacuum Oil Co., Inc., addressing the Detroit Economic Club.

Alberta's Reserves Growing

"Alberta has taken the position, and rightly so, that reserves of gas must be built up to the point where the requirements of the province are assured for a long period. There is little doubt this point has now been surpassed by a large amount and ultimately, I think there is little doubt, that the reserves will reach a point where they will be sufficient for both of the proposed eastern pipe lines as now envisaged."

Dr. George S. Hume, director general of scientific services, Ottawa, addressing the Prospectors and Developers Association, Toronto.

Strategy of Socialism

"How is gradual socialization to be put over? Well, it's a familiar campaign. Call all big business monopolistic.

"Where you can't sell that moss-covered idea (since 'mono' means 'one' and there is nothing even resembling a monopoly in any major American industry today), create a new specter called "oligopoly," or control by the few, and define that word "few" to mean whatever number of major competitors there happen to be in any given industry. It doesn't matter how strenuous the competition is within the industry, or between it and other industries, it can still be called an oligopoly—and that's an ugly word!

"Other regular tactics of the nibblers are to attack the motives of business and its leaders. Communists, Socialists, some leaders, and many politicians join in chanting the theme: Everyone who opposes them is simply power-mad and

Here's why

REED TOOL JOINTS LAST LONGER!

In every **REED** Tool Joint you will find everything that makes a tool joint safe and long wearing. The finest steels are machined with precision and given a "tailored" heat treatment. Threads are treated and every joint is given 120 separate inspections before it is stamped with the coveted Mark of Quality.

Here is a tool joint you can buy with complete confidence in both the product and the company that stands behind it.

REED ROLLER BIT COMPANY

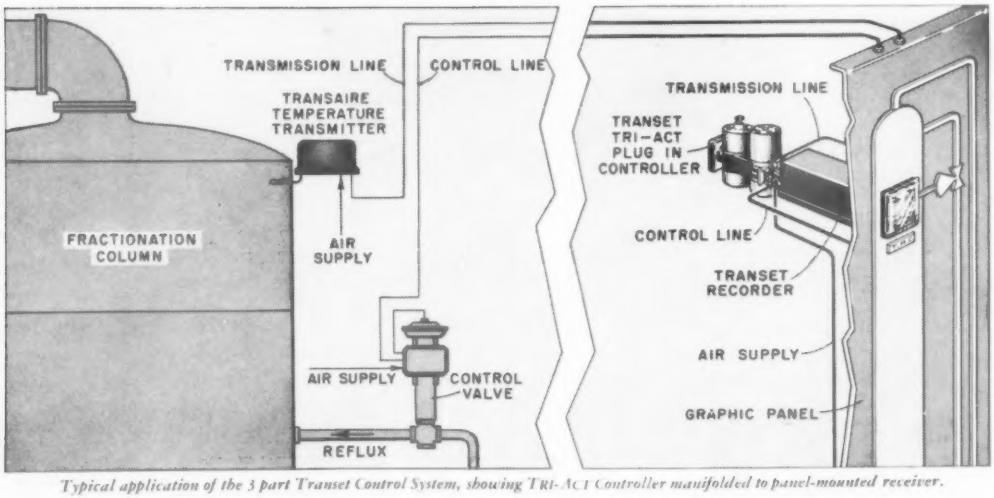
HOUSTON 1, TEXAS

THE MARK OF QUALITY

THREE RESPONSE ADJUSTMENTS, calibrated in specific units of measurement, enclosed for protection against tampering and corrosion.

PLUGS IN to universal, self-sealing manifold for either panel or field mounting. Simplifies both piping and maintenance. Manifold accommodates both TRI-ACT and BI-ACT Controllers.

TWIN CYLINDER CONSTRUCTION permits quick, easy access to any one controller element for alignment or maintenance without disturbance to any other element.



Typical application of the 3 part Transet Control System, showing TRI-ACT Controller manifolded to panel-mounted receiver.

Brand New

TRI-ACT®
CONTROLLER

The newest Concept in Process Control gives you:

1. Faster recovery on load changes
2. Start-up with no over-peaking
3. Benefits of automatic reset without its "evils"

THREE YEARS field experience proves new circuit principle not only sound but wanted more than ever. This unique force-balance controller capitalizes on faster speed of response of TRANSAIRE* measuring elements to give better control quality.

Easy Alignment. A fine thread gives a soft, vernier adjustment.

Settings "stay put". Permanent mechanical alignment. No one adjustment affects any other adjustment.

Pneumatically Stable. Practically insensitive to air supply variations. Gives wide range of settings in sensitivity (gain) and Pre-Act time (derivative) without upsetting stability.

Excellent Temperature Compensation — major construction refinements.

Interchangeability of TRI-ACT and BI-ACT* Controllers. Identical plug-in manifolds permit 10-second changeover with negligible process disturbance.

Die-cast Aluminum — light weight and corrosion resistant.

Response Adjustment Dials Totally Enclosed—full protection against tampering and corrosion.

Maintenance Simplified. Any one section of the instrument can be removed for servicing without disturbance to the remaining sections.

Buy one—try one on your toughest problem. There's no better way to prove the unprecedented performance of the TRI-ACT Controller.

Call your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

Trade Mark

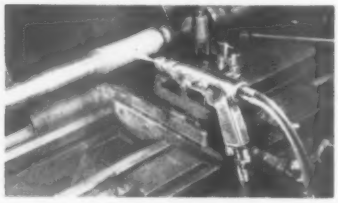
Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

Colmonoy No.6 hard-faced Slush Pump Rods stay in service Five Times Longer!

Prevent unnecessary shutdowns to replace worn rods and packing. Use rods that are hard-faced with COLMONOY No. 6. This miracle alloy has great resistance to abrasive and corrosive conditions, and is so smooth it reduces stuffing box repacking to a new minimum.

COLMONOY No. 6 is sprayed on in powder form, making a smooth, even overlay. This is *welded* to the rod with an oxy-acetylene flame. Only finish grinding is needed to put the part into service, to last 5 times as long as it would before hard-facing.

COLMONOY No. 6 is used on various pump and valve parts throughout the producing field and the refinery. Write us for the name of your nearest shop doing Spraywelding.



Above is a pump rod being Spraywelded with Colmonoy No. 6. At left is a slush pump rod that has been hard-faced with Colmonoy No. 6.

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greedy—their own motives are always pure. To mention some favorite targets:

"Attack bigness—try to convince small business that their primary interest is opposed to that of the larger concerns.

"Attack integration, or other factors which make for efficiency in large enterprises.

"Attack big business if prices rise, and attack them again if they cut prices.

"Attack the doctors or the insurance men if they show signs of resisting moves to regiment them.

"But never, never attack the real monopolists of today—Big Government with its desire to control everything, or the bosses of Big Labor whose power is rapidly becoming greater than that of government itself, as shown by the unfair advantages they have won by threats and by failure to cooperate, even since Korea."

Robert E. Wilson, chairman of the board, Standard Oil Co. (Ind.), addressing the North Texas Oil and Gas Association, Wichita Falls, Tex.

The Issue Is Justice

"The basic issue in the tidelands dispute is not conservation of oil or any other natural resource to ownership by either the states or the federal government; it is conservation to all of the American people of that most precious of all American things—justice under the Constitution of the United States.

"Either Louisiana owns its offshore areas to a certain distance at sea, or it doesn't. If it doesn't, a new theory of federal 'paramount rights' has been created after more than 150 years to the contrary, and no one knows how far that theory might be extended by future federal administrations. The states up to now have won their fight, before the American public, that the 'paramount rights' are those of the states. They are about to win this fight in Congress if they will stick to the single course of justice. That is the course they should pursue."

Editorial in the Shreveport Times.

Steer Clear of Agreements

"The simplest relationship in any business deal is directly between buyer and seller. It would not only be illegal, but foolhardy as well, for any trade association to attempt to bring about an agreement on prices, or other contract details, between two parties to a transaction."

Robert M. Bartlett, vice president, Gulf Oil Corp., addressing the Texas Oil Jobbers Association, San Antonio.

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Overloads are automatically by-passed and the flexible rubber fins allow the E-Z Swab to pass smoothly through tight spots on both the up and down strokes.

Since each Mission E-Z Swab rubber will lift approximately 400 feet of fluid, you can select the amount of fluid to be lifted before going in the hole by using one, two, or three rubbers.

One type Mission E-Z Swab rubber meets all swabbing needs. That's why Mission E-Z Swabs have set a new standard for fast, easy, successful swabbing under all conditions. Ask your Mission Representative for complete details or write for Bulletin EZ 751. Available through all supply stores.

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*Snap-on is the trademark of Snap-on Tools Corporation

CALENDAR

APRIL

15-17 National Petroleum Association, mid-year meeting, Cleveland.

20-22 American Petroleum Institute, Division of Transportation, products pipe-line conference, Hotel Muehlebach, Kansas City.

21 Association of Consulting Chemists and Chemical Engineers, Inc., Hotel Belmont Plaza, New York City, symposium and dinner.

21-23 Southwestern Gas Measurement Short Course University of Oklahoma, Norman.

22-23 Texas Petroleum Research Committee, sixth oil-recovery conference, Texas A. & M. College, College Station.

22-24 American Association of Petroleum Geologists, Rocky Mountain section meeting, Casper, Wyo.

22-24 American Institute of Electrical Engineers, southern district meeting, Hotel Seelbach, Louisville, Ky.

24-25 Interstate Oil Compact Commission, spring meeting, Roosevelt Hotel, New Orleans.

26-29 American Institute of Chemical Engineers, Chemical Institute of Canada, joint meeting, Royal York Hotel, Toronto, Ont.

27-28 Independent Petroleum Association of America, mid-year meeting, Jefferson Hotel, St. Louis.

APRIL 27-MAY 1 American Petroleum Institute, safety and fire protection committees sixth mid-year meeting, Galveston, Tex.

28-30 American Society of Mechanical Engineers, spring meeting, Deshler-Wallick Hotel, Columbus, Ohio.

Apr. 29-May 1 Natural Gasoline Association of America, annual convention, Rice Hotel, Houston.

Apr. 30-May 1 American Gas Association, transmission and storage conference, Edgewater Beach Hotel, Chicago.

MAY

4- 5 American Petroleum Institute, division of marketing, midyear meeting, Baker Hotel, Dallas.

4- 6 Liquefied Petroleum Gas Association, annual convention, Conrad Hilton Hotel, Chicago.

5- 6 Gas hydrate control conference, University of Oklahoma, Norman.

6- 8 American Society of Training Directors, ninth annual conference, Sheraton Plaza Hotel, Boston.

7- 8 American Petroleum Institute, Rocky Mountain district, Division of Production, spring meeting, Gladstone Hotel, Casper.

8 Society of Exploration Geophysicists, Pacific Coast Section, annual spring meeting, Hotel El Tejon, Bakersfield, Calif.

11-13 Southern Gas Association, Jung Hotel, New Orleans.

11-14 American Petroleum Institute, Division of Refining, midyear meeting, New York.

13-14 Pacific Coast Gas Association, annual gas supply and transmission conference, Santa Barbara, Calif.

14 Conference on Instrumentation in Water, Sewage, and Industrial Waste Treatment, Manhattan College, New York.

14-23 International Petroleum Exposition, Tulsa.

15-16 International Gas Union, council meeting, Paris, France.

19-22 The Institute of Gas Engineers, ninetieth annual meeting, London, England.

21-23 Panhandle Geological Society, field trip, Yucca Hotel, Raton, N. M.

24-27 American Gas Association, production and chemical conference, Hotel New Yorker, New York City.

25-28 Air Pollution Control Association, annual meeting, Lord Baltimore Hotel, Baltimore, Md.

25-29 American Society of Mechanical Engineers, annual conference and exhibit, oil and gas power division, Hotel Schroeder, Milwaukee.

27-29 Texas College of Arts and Industries, Kingsville, eighth annual short course in gas technology.

28-29 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Broadview Hotel, Wichita.

28-29 Natural Gas and Petroleum Association of Canada, London, Ont.

29-30 West Texas Geological Society spring field trip, Paisano Hotel, Marfa, Tex.

JUNE

2- 3 American Petroleum Institute, Division of Production, Pacific Coast District, Statler Hotel, Los Angeles.

4- 5 Kentucky Oil and Gas Association, annual meeting, Lafayette Hotel, Lexington, Ky.

7-12 Society of Automotive Engineers, summer meeting, The Ambassador and Ritz-Carlton Hotels, Atlantic City, N. J.

14-18 Canadian Gas Association, Windsor Hotel, Montreal, Canada.

15-19 American Association for the Advancement of Science, petroleum conference, Colby Junior College, New London, N. H.

15-19 American Petroleum Institute, Division of Production, midyear committee conference, Hotel William Penn, Pittsburgh.

16-19 American Welding Society, national spring technical meeting, Shamrock Hotel, Houston.

JUNE 16-JULY

2 Intensive Course and Research Conference on Phase Behavior of the Hydrocarbons, University of Michigan, College of Engineering, Ann Arbor.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Conrad Hilton Hotel, Chicago.

18-19 Pennsylvania Grade Crude Oil Association, annual meeting, Hotel William Penn, Pittsburgh.

24-27 Intermountain Association of Petroleum Geologists, fourth annual field conference, Ogden, Utah, to Jackson, Wyo.

June 28-July 2 Petroleum Equipment Suppliers Association, annual meeting, Broadmoor Hotel, Colorado Springs, Colo.

JUNE 29-JULY 3 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

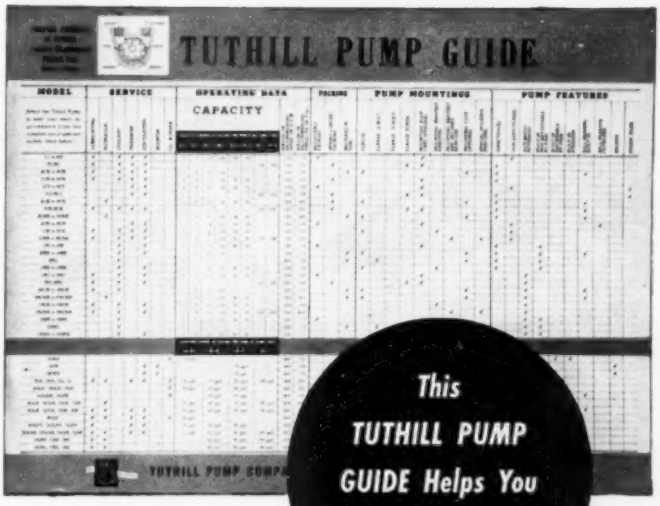
JULY

July 30-Aug. 1 Wyoming Geological Association, eighth annual field conference, University of Wyoming, Laramie.

AUG.

17-19 Society of Automotive Engineers, international West Coast meeting, Georgia Hotel, Vancouver, B. C., Canada.

NEW EASY WAY TO SELECT THE RIGHT PUMP FOR THE JOB



To save you time and trouble in selecting the pump best-suited to your application, Tuthill engineers have developed this revolutionary new Pump Guide. Here, in one easy-to-use chart, is a volume-full of information on the complete line of Tuthill Pumps.

At a glance, it shows you the services for which each model is built, together with performance characteristics, types of packing, mounting styles and distinctive features that enable you to fit the pump to your need, rather than the need to the pump.

Tuthill Positive Displacement Pumps serve Industry in Lubrication, Hydraulic, Coolant, Oil Burning, Circulating and Transfer Service.

Copies of this helpful guide are now available on request. Write for yours today—there's no obligation.

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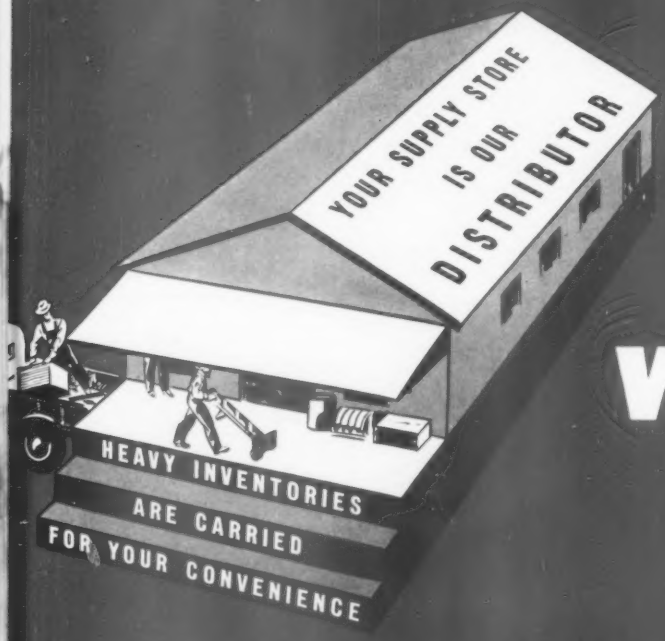

WHEN YOU NEED IT

WHERE YOU NEED IT

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To have the right equipment, at the right place, at the right time is the purpose of the over 900 supply stores serving the oil industry. Huge inventories of all types of materials in every oil producing area are carried for the convenience and service of all phases of the oil industry.

Realizing that minutes mean money to oil men, this tremendous field stock is maintained so that you will have what you need, when you need it and where you need it. This is the time-saving, cost-saving way to get what you want — when you want it.

This company maintains six field warehouses at strategic locations —

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JOURNALLY Speaking

D & D Museum

GOT any old working models of refineries, oil wells, pipe lines, salt domes, or other appurtenances of the petroleum industry that you'd like to place in a good home?

Send them to the National Oil Museum and Hall of Science. Never heard of it? You will. It's just been chartered as a nonprofit corporation to establish and maintain a museum in Tulsa.

At present it's also a nonincome corporation and its first official act was to create a committee on ways and means, so if you feel like bequeathing it a couple of million bucks in your will or contributing a 3-cent stamp to reimburse the organizing committee for the cost of mailing the charter application, same will be gratefully appreciated and you might get your name engraved on the cornerstone when the museum is built.

In the meantime the fledgling corporation has two other committees at work, scurrying around to (1) find a temporary building to house any exhibits which might be acquired and (2) acquire exhibits to put into any building which might be found.

This might sound like a futile, frustrating, and inauspicious start, but it isn't. Some of the best brains of the oil industry in these parts are behind the project in a big way.

The scheme was hatched in the fertile minds of the Tulsa Desk and Derrick Club many months ago. The girls thought the oil industry ought to have a permanent educational exhibit of its equipment, processes, and methods of operation, and since nobody else seemed to be interested in starting one anywhere in the Southwest, they figured Tulsa was just the place for it and they were just the people to launch it.

The girls kicked the idea around for quite a while and then decided that it was too big for them to handle all by themselves, so they asked for help. They got it. Inspired by the girls' enthusiasm, local interests took hold of the idea and pushed through the incorporation in jig time. But the Desk and Derrick Club is still the prime mover in the project and is well represented on the board of directors and the slate of officers.

Dozens of plans were proposed, but it was finally decided that the important thing was to get a start, and the way to get a start was to start. So it's started.

The nucleus of the museum, it is hoped, will come out of the Oil Show to be held in Tulsa in May. Some of the exhibitors may be induced to leave their displays in custody of the museum directors and perhaps one of the Oil Show buildings can be wangled as a temporary home for them. Then oil companies and others will be canvassed for suitable display material, and plans will be pushed for providing a permanent building. From the way in which the committees are going at their job it's a safe bet that the National Oil Museum will be a lot more than just a paper organization before very long.

Meanwhile, if you have any petroleum memorabilia, educational displays, or negotiable securities which the new museum could use, write to President W. B. Way in care of the International Petroleum Exposition which he also heads.

German Museum

A DISPLAY of the very early history of the oil industry in the United States is being erected in the German Museum in Munich. Germany is now an oil-producing country, in a small way, and this museum is creating a new department devoted to the petroleum industry.

Because Germany joined the petroleum parade about three generations late, it naturally had to turn to this country for material on the industry's beginnings, and the Drake Museum at Titusville, Pa., is supplying it with material. That old stuff is very interesting but, we think, most people would be even more interested in displays showing how the oil industry operates today and some of the things it does to find, extract, and refine the oil needed by today's customers.

—Henry D. Ralph

Keep Cement
WHERE YOU WANT IT

with BAKER "METAL PETAL" BASKETS

Where a lower zone must be protected from contamination by the cement slurry (as well as from sloughings and cavings) the Baker Metal Petal Basket will be found both safe and successful.

The unit is constructed of a number of individual "petals" made of flexible sheet metal. These petals are mounted on reinforcing spring steel ribs, which in turn are mounted on a ring to form a Basket.

When running-in the hole, the upward pressure of the fluid tends to close the "petals" thus providing fluid passageway between the Basket and the walls of the hole, without distortion of the Basket. As soon as the Basket comes to rest, upward pressure by the fluid is relieved and the petals expand to contact the walls of the hole. Any tendency of fluid to move downward then presses the flexible petals more firmly against the entire circumference of the hole. Solids strained from the fluid tend to build a bridge inside the Basket which is thus converted into a one-way, open hole packer of great strength and effectiveness.

SIMPLE, EFFECTIVE ACTION

The "Metal Petals" not only expand to contact the circumference of large-diameter holes, but also pack-off in holes of irregular shape; and the independent action of the individually mounted overlapping petals permits successful use of the Basket in casing programs with minimum clearances.

All-metal construction and design provide ample strength; lessen the possibility of splitting or otherwise damaging the Basket.

Baker Metal Petal Baskets are "slidably" mounted to permit rotation, spudding, or reciprocation of the casing without distorting or damaging the Basket.

MOUNTINGS TO MEET ALL NEEDS

Baker Metal Petal Baskets are furnished mounted on plain or perforated nipples; with or without different types of Baker Whirler Float Collars; for a wide range of cementing applications.

Maximum efficiency of Baskets is assured when Baker Casing Centralizers are used immediately below and above the Basket Assembly.

Ask any Baker representative for specific recommendations as to how Baker Metal Petal Baskets solve specific cementing problems

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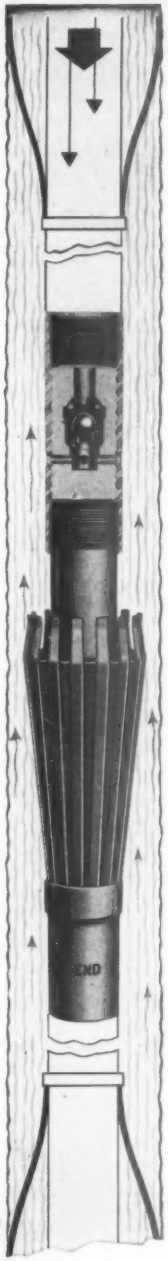

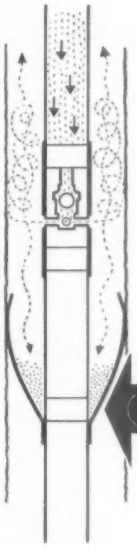

A popular hook-up consists of a Baker Metal Petal Basket mounted on nipple, with a Baker Cement Whirler Float Collar with Solid Baffle (Product No. 305) which whirls the cement slurry outward and upward through the baffled, side-whirler ports.

BAKER
"METAL PETAL"
BASKET
PRODUCT NO. 340

The overlapping "petals" (each mounted on its individual spring steel rib) provide flexibility and freedom of expansion to pack-off around the circumference of large-diameter holes, or holes of irregular contours.

Spraberry burns while FPC fiddles

POLITICIANS and consumers in eastern cities who think that the federal Government should have more power to regulate the production and gathering of natural gas should take a close look at the situation in West Texas.

Today the huge Spraberry field is shut down by order of the Texas Railroad Commission because the field has been flaring and wasting some 220,000,000 cu. ft. of natural gas every day. All the while there have been natural-gas pipe-line companies which have lines in the general vicinity of Spraberry and which are anxious to buy the gas which the producers have had to burn for lack of a market.

Why haven't producers and buyers been able to get together? Why hasn't this wasted gas been gathered and taken to the markets which are eager to get it? Simply because the Federal Power Commission has not yet given permission for the transmission companies to extend their pipe lines into the field.

WAY off in Washington, D. C., 1,500 miles from Spraberry field, sits the agency which feels it must pass on every dollar of expenditure, every foot of pipe line, proposed by an interstate gas company. It gives lip service to conservation, but its operations reveal that its chief interest is to protect consumers against possible rate increases caused by imprudent expenditures or practices by transmission companies.

The FPC has a standard pattern for the operation of a public utility, one aspect of which is that every new construction project must go through a long and delaying procedure of hearing and investigation, and must work its way up from the bottom of a crowded docket. While buyers clamor for gas being flared into the Texas sky, FPC's bureaucratic mill slowly grinds through details of the pipe-line company's interest charges, accounting practices, and consumer contracts.

In the fast-moving oil and gas business an operator should be able to take quick action and adapt his plans to conditions of the moment. But gas pipe lines are hamstrung by the rigid utility pattern and bureaucratic regulatory methods of FPC.

IF the gas companies had been free to act promptly months ago when Spraberry flaring first reached large proportions, the field's gas today would be flowing into transmission lines, and oil production would be continuing in an orderly manner.

With such a record, how can FPC profess to have a real concern for conservation? And what sort of treatment could gas producers, processors, and gatherers expect if FPC succeeds in extending its jurisdiction to their operations?

That's Anchor, ready to help you with all your marketing-transportation problems. Your specialty is production and/or refining. Our specialty is marketing petroleum products. Turn your marketing to us and have more time for your specialty. We have the knowledge, the facilities and the desire for your business. Call us, now, 2-7261, Tulsa.

Anchor is a Merchant of Petroleum Products, buying surplus stocks or supplying your needs in: **BUTANE • PROPANE • NATURAL GASOLINE • FUEL OIL • DIESEL OIL NAPHTHA • KEROSENE • OTHER PETROLEUM PRODUCTS.**

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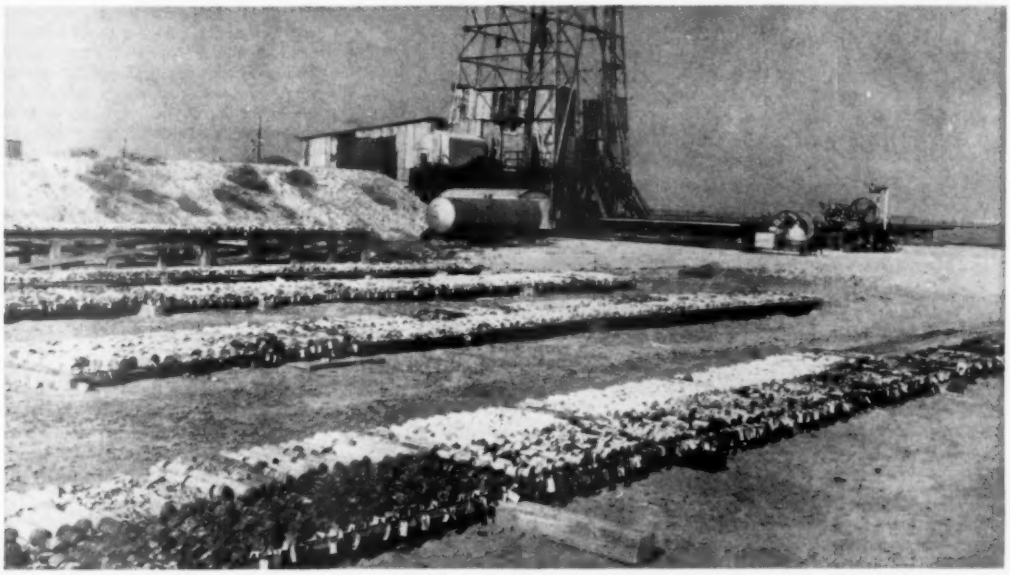
THIS WEEK



7,000 FT. OF SECTION is represented by these cores from Ohio Oil Co.'s deep test in Paloma field near Bakersfield, Calif. Coring was started at about 10,500 ft. and has been continuous since 14,000 ft. to the current depth of about 18,000 ft.—second deepest test ever drilled in California. Most of the cores are 4½ in., cut with a diamond core head. The well, 72-4 K.C.L.A., is seeking production in lower Miocene and Eocene formations and possibly might go below 20,000 ft. The deepest test so far in the state is Superior Oil Co.'s 18,734-ft. venture in the Montalvo are near Ventura. Ohio Oil is operator of the Paloma Unit.

GOVERNMENT.—Proposed quota on oil imports to be principal issue in hearing of House ways and means committee on Reciprocal Trade Act, scheduled for next week. . . . ¶Only 2 weeks remain for Justice Department to determine its course on cartel case. . . . Three-month delay granted so incoming administration could familiarize itself with details will expire April 28. . . . ¶Senate minority group planning a talkathon to delay approval of bill recognizing rights of states to resources under waters within their historic boundaries. . . .

INTERNATIONAL.—Pemex considering building new refinery at Tampico to process heavy crude. . . . ¶Plan would involve products line to Monterey. . . . ¶Neutral Zone wildcat of American Independent tests 2,500 bbl. daily from first Burgan sand, 2,000 bbl. daily from lower sand in drill-stem tests. . . .

PIPE LINES.—Lakehead Pipe Line lets contracts to eight contractors for construction of the 30-in. extension of the Interprovincial pipe-line system. . . . The $76,000,000 project will extend 635 miles from Superior, Wis., to the international boundary at Port Huron, Mich. . . . ¶Plantation Pipe Line Co. reveals it will lay an 82-mile, 14-in. products-line loop on its system between Charlotte and Greensboro.

INDUSTRY.—Tennessee Gas Transmission announces plan to sell 1,000,000 shares of stock, use proceeds to buy 25 per cent interest in American Republics and merge with that company Tennessee Production Co. . . . ¶Humble, biggest domestic producing company, discloses it made less last year than in 1951, in spite of more production, greater revenue. . . . Difference blamed on increased costs, caused by deeper drilling, more wildcatting, bigger percentage of dry holes, and other factors. . . . ¶O.W.I.U. announces it will seek company-wide contracts this year, but will bargain on "whatever level we can meet the employers." . . .

REFINING.—Monsanto Chemical Co. announces it will erect a huge new petrochemical plant which would manufacture 66,000,000 lb. per year of polyethylene by 1955 and almost 100,000,000 lb. in 1957. . . . This would amount to about 20 per cent of national production capacity projected by Monsanto for 1957. . . . ¶Texaco's Kuhn, head of technical and research division, warns ethylene glycol producers to take good look at market situation for that petrochemical. . . . Production, he says, finally has overtaken and is substantially in excess of consumption. . . .

TRENDS.—Refinery runs for the 2-week period ended April 4 were 187,000 bbl. daily less than average for first 2 weeks of this year. . . . Largest cuts were on the East Coast and in the Illinois-Indiana-Kentucky district, down 90,000 and 107,000 bbl. daily respectively. . . . Runs on the Texas Gulf Coast were up 19,000 bbl. daily and 43,000 bbl. daily higher in California. . . .

ACTIVITY.—Production of crude and lease condensate averaged 6,338,850 bbl. daily for week ended April 4, down 158,625 bbl. daily. . . . ¶Total well completions decreased 29 wells for the week to 871. . . . ¶Wildcat completions totaled 178, off 40 wells for the week and 10 from corresponding week last year. . . . ¶For week ended April 6, rotary rigs operating in United States regained 24 of the 30 rigs lost the preceding week to end with 2,504. . . .

BIG-INCH LINES . . . like the Rancho, shown here while under construction, now give the Permian basin more outlets for crude than it can produce at present.

Permian Basin Blues

Early predictions of surge in drilling play and producing rates with completion of new crude outlets not borne out

Henry D. Ralph

MIDLAND. — The Spraberry shutdown isn't the only thing worrying the oil producers of the Permian basin these days.

Drilling activity and production rates have been declining in recent months, and the completion this spring of two big new pipe lines has not brought the upsurge of activity that was expected when the lines were first proposed.

For years West Texas and New Mexico complained that their oil activity was being held down by lack of adequate markets for their crude oil.

First it was the crude-oil purchasers who got the blame, because they preferred crude from other parts of Texas closer to refineries and tanker terminals. But the Texas Railroad Commission now applies its market-demand proration law in such a way as to make purchasers take their fair share of Permian basin crude.

Then pipe lines got the blame. Permian basin producers felt that their oil activity would increase at a more rapid rate if there were more pipe-line capacity out of the area.

Now two new big-inch lines are just going into service. The 24-in. Rancho system can take 210,000 bbl. per day to the Houston area, and the 26-in. West Texas-Gulf line can feed 300,000 bbl. per day into other lines originating in East Texas.

This is a net gain, however, of only about 348,000 bbl. daily, because lines with a capacity of approximately 162,000 bbl. daily are going out of crude service, including the 10-in. Shell line to Houston which Phillips Petroleum Co. is acquiring to move partially processed liquids from West Texas natural-gasoline plants to its Sweeny refinery. Gulf's three 10-in. lines running to Port Arthur via Ranger also will be taken out of crude service, and one or two of them similarly may be converted to L.P.G.

But this gain in pipe-line capacity of close to 350,000 bbl. per day has not increased Permian basin crude production. The new lines are simply diverting movements from older lines.

Why output is static . . . The chief explanations are that the demand for all Texas crude has fallen off in recent months, and producing capacity of West Texas has not increased as fast as was anticipated when the lines were projected.

As a matter of fact, crude lines running out of the Permian basin could carry around 500,000 bbl. per day more crude than was actually being produced in West Texas and New Mexico during the last week in March, just before the Spraberry shutdown cut another 80,000 bbl. per day from the region's output.

The accompanying table shows that the theoretical capacity of all crude lines from the Permian basin is sufficient to move 1,747,000 bbl. per day. This may be a bit above the actual year-in-year-out operating capacity. On the other hand, many of these lines could readily boost their throughput by adding more pumps.

Last January the Texas Railroad Commission's allowables for West Texas—Districts 7-C and 8—were 1,254,575 bbl. per day, but production in those districts during the first week in January was only 1,128,650 bbl. per day. New Mexico produced 178,550 bbl. per day that week, making the total crude output 1,307,200 bbl. daily. New Mexico refines about 16,000 bbl. per day of her own crude, and operating refineries in West Texas handle about 44,000. Deducting 60,000 bbl. of crude processed in the region, the Permian basin area had around 1,247,200 bbl. per day for pipe-line shipment.

The April allowables for Districts 7-C and 8 have been set at 1,137,761 bbl. per day. Actual production in those districts for week ended April 4 was 1,045,475 bbl. daily. This included 4 days under the lower April allowable. New Mexico added 183,450 bbl. daily, so deducting for crude refined locally there was about 1,168,925 bbl. per day for the pipe lines.

Comparison of these figures on actual production with the total pipe-line capacity of 1,747,000 bbl. per day shows how much Permian basin production could increase before pipe-line capacity again squeezes producers.

If output were at MER . . . If there were no market-demand allowables and all wells produced up to the limits of their theoretical maximum efficient rates, the producing ability and pipeline capacity would be in approximate balance. The MER of District 7-C has been estimated at 313,000 bbl. per day and that of District 8 at 1,505,000. New Mexico's MER has not been officially estimated recently, but a figure of 200,000 bbl. per day probably is reasonable. This adds up to a maximum producibility of about 2,000,000 bbl. per day, including the needs of local refineries.

But the catch in this is that not all wells can produce at their theoretical maximum efficient rate for 24 hours a day every day in the month for various reasons. The rapid decline in production of many Spraberry wells is an illustration, and for West Texas as a whole actual production has usually been appreciably below allowables.

Most engineers figure that about 25 full days per calendar month is a work-

ing average for estimating potential producing capacity. On this basis the producibility of Districts 7-C and 8 would be around 1,450,000 bbl. daily. With New Mexico's potential added, the total crude available would be rather close to the total pipe-line capacity out of the region.

Drilling slump deplored . . . Of course the operators out here have high hopes that production will start upward in the near future. But they shake their heads over the fact that last week only 805 drilling rigs were operating in the region compared with 1,066 a year ago.

This decline in drilling is due primarily to three factors: (1) Disappointment with the Spraberry, which caused many operators to pull out or drastically reduce their development programs; (2) the high cost and small yield of many completions officially rated as successful wells but which are marginal as commercial producers; and (3) the world-wide surplus of crude oil with its attendant threat of a soft market for crude at a time when exploration and production costs are still rising.

Cool on new line . . . This situation explains why West Texas producers, by and large, are not very excited about rumors that a new pipe line is going to be built from the Permian basin to Los Angeles. The prospects for this project have been hot and cold, up and down, for 6 or 8 years, which may be one reason why producers here apply a grain of salt to the current gossip that the project is getting new backing from strong interests.

A few years ago, when the Permian basin could produce more crude than existing pipe lines could move out, West Texas producers would have jumped at the prospect for a new market outlet in California—or anywhere else. Today they seem only mildly interested in reports that agents for West Coast Pipe Line Co. (still a paper organization) are actively working to sign up commitments for crude as a basis for financing the Los Angeles line.

They explain their indifference this way:

Even with a big chunk of the Los Angeles market available by the proposed line—60,000 to 150,000 bbl. per day initially and double that eventually—the Texas Railroad Commission probably would continue to allocate market demand on a state-wide basis. Having once interpreted its statute to prevent discrimination against West Texas, it is unlikely that the commission would reverse its policy to give West Texas special favors. And with the additional market demand spread throughout the state's fields, West Texas' share would not be huge.

No matter how big a pipe line is, it is useless unless there is crude to fill it and markets to use the oil. At present the Permian basin could barely produce enough crude to crowd all present pipe lines, even if the market could take all they can carry. The California market is unknown to Permian basin producers, and they consider it uncertain because California might be able to increase its own crude output, Canadian crude is scheduled to move into the West Coast in big volume next fall, and an end to the Korean war might bring a big drop in demand on the Pacific Coast.

Unless West Coast crude buyers offer a premium above posted field prices—an unlikely possibility—most producers would be reluctant to cancel their present connections with established pipe lines and sign up with a new and unknown outfit. Crude buyers for the presently partially filled pipe lines would not feel kindly toward producers who cut them off for an "upstart" competitor, and these purchasing companies are in position to do a good many favors for producers.

Eventually, producers here believe, a crude line may be built to California, but even if it were in operation today they feel it would not do much to increase drilling and production in the Permian basin.

PERMIAN BASIN PIPE-LINE OUTLETS

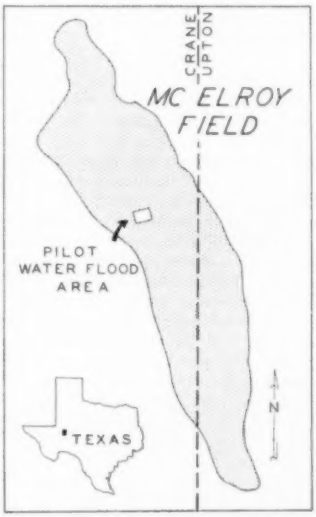
	Capacity (bbl. per day)
East and Southeast:	
Atlantic to East Texas	46,000
Atlantic to Corpus Christi	44,000
Humble to Houston	140,000
Humble via Comyn to Houston	46,000
Humble to Corpus Christi	73,000
Magnolia to East Texas	117,000
Texas-New Mexico to Houston	68,000
Rancho to Houston	210,000
West Texas-Gulf to East Texas	300,000
Subtotal	1,044,000
North and Northeast:	
Phillips to Borger	70,000
Basin via Oklahoma	355,000
Shell via Oklahoma	41,000
Service to Drumright	160,000
Service via Bowie to Oklahoma	32,000
Subtotal	658,000
West:	
Pasotex to El Paso	45,000
Total capacity	1,747,000

Antitrust-Suit Appeal Set

AUSTIN.—Texas Atty. Gen. John Ben Shepperd said here last week he will file an appeal before April 20 of a District Court verdict against the state in its antitrust suit against 10 major refiners. The suit was filed in District Court in 1949 by Price Daniel, former attorney general and currently a U. S. Senator, who alleged that the refiners collaborated in raising the price of gasoline after federal price controls were lifted in 1946.

The trial court ruled that the state failed to show any cause for action and upheld defense allegations that the charges were too vague to answer.

The companies involved are Magnolia Petroleum Co., Cities Service Oil Co., Standard Oil Co. of Texas, Humble Oil & Refining Co., Continental Oil Co., Sinclair Refining Co., The Texas Co., Phillips Petroleum Co., Gulf Oil Corp., and Arkansas Fuel Oil Co.



GULF'S PILOT flood being expanded. Map from Midland Map Co. base.

Flood Expanded

Gulf enlarging single-well experiment in McElroy field

Joseph A. Kornfeld

CRANE, Tex. — First expansion of water-flooding experiments in the famed McElroy Ranch oil field, a major 14-mile-long West Texas pool 2 miles north of here was commenced April 1 by Gulf Oil Corp., the operator.

Water injection into an enclosed 20-acre 5-spot project was started following approval March 9 by the Texas Railroad Commission of the plan to expand the 6-year-old single-well experiment.

Gulf started the pilot flood in March 1947 using well No. 286 in Section 201, Block F, CCSD&RGN Survey, a well immediately north of the field

center and at the north end of McElroy Ranch.

Produced water was returned to the Grayburg (Permian) formation, the principal oil pay, found at about 2,900 ft. This formation is gray and brown crystalline dolomite with sandy and oolitic zones in the upper portion. Nodular and inter-crystalline anhydrite are found throughout the producing section and form the cementing material in certain areas and zones.

Injection rates ranged from 2 to 30 bbl. per day per foot of pay. Nearly 600,000 bbl. of produced water had been injected to February 1, 1953.

Positive results from the 6-year experimental water injection are shown by increases in oil rates observed on several offset wells. At others of the seven offsets, the normal decline trend has been arrested.

Field potentialities . . . Gulf engineers believe that the efficient operation of this pilot, and its expansion, should determine also the feasibility of a field-wide water-flood program and form a sound basis for future secondary-recovery planning in this area.

McElroy is particularly outstanding in cumulative recovery among Permian dolomite reservoirs. Its cumulative production of more than 226,000,000 bbl. of oil represents an average recovery of 237,000 bbl. per well from its 954 oil wells and an average recovery of 11,900 bbl. per acre from its 19,080 proven acres. In a recent month the field produced 668,272 bbl. of oil from 929 wells or a daily average of 21,557 bbl. Gravity ranges from 29° to 32° A.P.I.

Sprawling over eastern Crane and western Upton counties, McElroy extends for a maximum length of 14 miles from northwest to southeast. Its maximum width exceeds 3 miles.

Atlantic Given Exception

AUSTIN.—Atlantic Refining Co. has been granted permission by the Texas Railroad Commission to continue its water-imbibition experiment in Spraberry Trend area field.

In an exception to its order shutting in production in the huge field because of gas flaring, the commission designated 25 wells which may be produced in connection with the imbibition tests. Imbibition is the name given by Atlantic to its new water-injection secondary-recovery process which has been under test in the field since November.

The commission also gave authority to the Bureau of Mines to complete its pressure buildup tests started before April 1, allowing it to use all oil needed but providing that all production would be taken off future allowables.

In seeking an exception to the shutdown order, which became effective April 1, Atlantic told the commission its experiments were at a "critical stage" and a shutdown could preclude any future evaluation of the experiment's results because of the time factor.

Company officials said the process "looks encouraging" and declared if the tests are successful the new technique could increase Spraberry oil recovery by "many millions of barrels."

Humble Report

Biggest company took in more but made less in '52

HOUSTON. — Increased costs in all phases of oil-industry operations caused Humble Oil & Refining Co.'s income to drop $24,000,000 in 1952, compared with 1951, in spite of a larger volume of production and a larger gross revenue.

Hines H. Baker, president, and L. T. Barrow, board chairman of the nation's biggest domestic producing company, said in Humble's annual report that it cost a third more to drill a well in 1952 than in the year before.

With an average well costing $106,500 drilling costs for the 1,102 wells drilled in 1952 amounted to more than $118,000,000. Higher costs were due to increase in average depth, increase in number of exploratory wells, and increased costs for materials and wages.

Increased exploratory drilling and a larger proportion of dry holes in development drilling were principal factors causing Humble's expenditure for dry holes in 1952 to be some $43,000,000, an increase of $14,000,000 over 1951.

Producing wells operated by Humble increased by 467 during the year to 11,333 at the end of the year, not including 170 wells then shut in in Fort Chadbourne field.

Production operating costs increased sharply during 1952 due to:

1. A major workover program to increase current production and ultimate recovery of oil.
2. Greater depreciation charges resulting from higher investment costs in recent years.
3. Record costs for exploration and dry holes.
4. Addition personnel and expenses involved in operating more producing leases and wells.
5. Higher rates of pay.

Humble had a net production of 349,600 bbl. per day of crude oil plus 29,000 bbl. per day of liquids from gas plants. During the year 241,887 million cubic feet of gas was sold. In refining operations, 92,084,000 bbl. of crude oil was refined, setting a new company record.

Fertilizer Aplenty

Biggest sphere ever built in a farming region for fertilizer storage is this one of Shell Chemical Corp. at Kerman, Calif., which holds 1,000,000 gal. of ammonia, enough to fertilize 65,000 acres of land. The huge storage vessel, easily seen from 10 miles away, will supply NH$_3$ for use in the San Joaquin and Salinas valleys.

CANADA

New Refinery Planned

KAMLOOPS, B. C.—Refinery Operators, Ltd., of Calgary, Alta., will begin construction in July of a new 5,000-bbl. refinery near Kamloops, according to E. B. Lay, president.

Facilities of the $6,000,000 plant will include a catalytic cracking unit, Lay said.

Site of the new plant is on the right-of-way of Trans Mountain Pipeline Co.'s big crude trunk line now under construction. Refinery operators has contracted with Trans Mountain for crude-oil supply, Lay said.

McMurray Tests Lucrative

EDMONTON, Alta. — Companies conducting core-drilling tests in the McMurray oil sands area of northeastern Alberta have paid the Alberta government more than $600,000 since 1950 by way of fees, rentals, and deposits.

Premier Manning reported to the legislature that payments to the province were made by: Lloyd Rogers Champion, Calvan Consolidated Oil and Gas Co., Ltd., Asher Oil Co., Ltd., Pacific Petroleums, Ltd., New Continental Oil Co. of Canada, Charter Oil Co., Ltd., Socony Vacuum Exploration Co., Sun

Oil Co., Edward E. Gilbert, Rio Tinto Alberta Oils, Ltd., Shell Oil Co., and Shell Comar Exploration, Ltd.

Mr. Manning reported that one deposit for $10,000 was forfeited for nonperformance of required core testing during February 1951. This forfeiture was by Mr. Champion, who still has other holdings in the area.

Pipe-Line Firm Approved

OTTAWA, Ont. — The House of Commons has approved a bill incorporating Mid-Continent Pipelines, Ltd., which is planning to lay a big-inch gas line from Alberta gas fields to markets in Ontario and Quebec by an all-Canadian route.

The action of the lower house followed approval of the measure by a Commons committee *(The Oil and Gas Journal, April 6, 1953)*. The bill had already been passed by the Senate.

Originally, the line was planned to cross a portion of the northern United States, but government approval was withheld until the company agreed to change to the all-Canadian route. As it now stands, the big trunk would extend from Alberta to Winnipeg and thence north of the Great Lakes, serving communities along the right-of-way and such large centers as Toronto, Montreal, and Ottawa.

The company is backed by a group of Canadian business men, mostly from Toronto. It has engaged Fish Engineering Co., Houston, to engineer the project, provided government permits are obtained.

MID-CONTINENT

Sinclair to Dedicate Line

CUSHING, Okla.—Sinclair Pipe Line Co. will dedicate its 657-mile big-inch crude oil line at the line's No. 1 pump station here April 27.

Gov. Johnston Murray will be principal speaker at the ceremonies, to be attended by Sinclair and other oil-company officials and government and civic leaders.

The line runs from Cushing to East Chicago, Ind., and represents an investment of $52,000,000. The line is of 24-in. pipe from Cushing to Salisbury, Mo., where it connects with the Platte Pipe Line for service to Wood River, Ill. This section has a capacity of 280,000 bbl. per day. From Salisbury the line is 22 in. in diameter and has a capacity of 150,000 bbl. daily.

Elk City Expansion Sought

OKLAHOMA CITY. — The Oklahoma Corporation Commission has set for hearing June 9 an application of Shell Oil Co. and member-companies in the Elk City Hoxbar Sand-Conglomerate unit pool for a third enlargement of the deep multizone field in Beckham and Washita counties.

The new enlargement would add 54 wells and 2,160 acres and bring the totals for the unit to 255 wells and 10,200 acres. Productive limits of the big structure are not yet defined on all sides, and several drilling rigs are operating in the field.

Shell is joined in the application by Decem Drilling Co., J. B. Hawley, Jr., Superior Oil Co., Tide Water Associated Oil Co., Union Producing Co., and United Carbon Co., Inc.

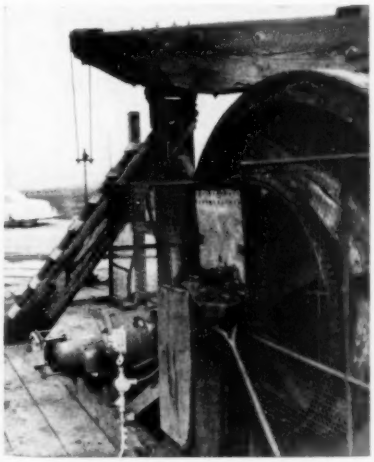
The first order creating the unit field was issued by the commission on October 27, 1950, and became effective January 1, 1951. The first enlargement took effect on February 1, 1951, the second on October 1, 1952.

Shell Oil Co. operates a natural-gasoline-extraction and pressure-maintenance plant in the field.

New Company Formed

WICHITA, Kans.—Royal Oil Co. has been formed here as a drilling and producing company. A. R. Frenette is president of the company and Emmett Blaes, vice president. Royal will develop leases held by Midwest Foundry, Inc., Wichita, in Oklahoma, Kansas, and Nebraska.

TYPICAL WELL before Kern River modernization.



SAME WELL with putt-putt removed.

Familiar Sound Fading at Kern River

THE putt-putting of pumping engines which has been heard since shortly after the turn of the century at Standard Oil Co. of California leases in Kern River field in the southeastern portion of the San Joaquin Valley in California is almost a thing of the past.

The uneconomical standard pumping fronts on 312 of the 426 wells Standard has in this and nearby fields have been replaced by 10-hp. electric motors and speed reducers. The old walking beams are being continued in service after being shortened to work with the new power source.

Production Group Meets

Several areas in Central Pennsylvania appear favorable for Devonian exploration, eastern A.P.I. attendees told

PITTSBURGH.—Petroleum engineers from western New York, Pennsylvania, West Virginia, and eastern Ohio gathered here April 8-10 at the William Penn Hotel to analyze a dozen papers presented at the spring meeting of the American Petroleum Institute's Division of Production.

Reports were presented on Devonian oil and gas prospects in Central Pennsylvania, drilling in the Leidy and Driftwood gas fields, and advances in applying secondary-recovery methods in eastern oil fields.

Devonian prospects . . . Oil and gas prospects in the Devonian in Central Pennsylvania were analyzed by Earl H. Linn, Benedum-Trees Oil Co., Pittsburgh, who presented a preliminary study of the stratigraphy and sedimentation. Sedimentary environment and resulting lithology were given special attention via isopach and lithofacies maps. A number of areas were pinpointed as appearing favorable for future prospecting.

Linn also presented views on Oriskany gas production in North Central Pennsylvania and commented as to reasons why so many structures are barren in the area. He also reviewed the various hypotheses of why no oil or gas has been found to date in the Upper and Middle Devonian in Central Pennsylvania.

Accumulation in West Virginia . . . Petroleum accumulation in West Virginia and paleozoic geography relationships were detailed by Oscar L. Haught, West Virginia Geologic and Economic Survey, Morgantown.

Problems of ancient geography of importance in West Virginia include the locations of Cambrian shore lines and zones of sedimentary transition; also the presence, number, and character of Ordovician and Silurian unconformities, as much as these depend directly upon geographical changes. Haught said prospects exist within the state for accumulations, related to each of these factors, but they can be tested only by drilling.

Drilling costs . . . Rotary-drilling costs in the Leidy and Driftwood gas fields were discussed by John W. Hendrickson, New York State Natural Gas Corp., Pittsburgh. New York State Natural has found that combination rotary-cable costs exceed those of cable tools alone in Leidy and Driftwood, but the rotary-plus costs are not prohibitive for drilling development or in-pool wells when speed is the prime factor. For wildcat wells drilled to approximately 8,000 ft., the combination costs considerably exceed those of cable tools alone. Hendrickson believes, however, that the operators should begin to think in terms of higher per-foot drilling costs if rotary drilling is to become established in this area.

Byron M. Finch, Pipe Line Construction & Drilling Co., Pikesville, Ky., maintained at the meeting that there is now a permanent place in the East for continued rotary drilling. Finch said during the past 2 years more rotary tests have been drilled than ever before in the history of the Appalachian region (26 through the Oriskany sand and deeper). The California Co. in 1951 completed a top-to-bottom rotary test at 12,343 ft.—the deepest well ever drilled in the State of Pennsylvania.

Oil-field cores . . . J. C. Calhoun, Jr., C. R. Killins, and F. W. Preston, all of Pennsylvania State College, spoke on "Intensive Analyses of Cores." They reported that the maximum amount of information can be obtained from core analyses by working with cores in such a manner as to have them as closely as possible in their original state. Although this ideal can never be achieved, it can be approached.

One of the primary quantities to be learned concerning a reservoir rock is its wettability. The evaluation of rock wettability can be made by several methods, including the imbibition of various fluids, capillary pressure tests, or the degree of saturation which can be achieved.

Selective plugging . . . Channeling of gas-injection wells might be alleviated with smoke, according to Paul T. Bail, U. S. Bureau of Mines, Bradford, Pa. Bail presented preliminary laboratory work and results from a field trial of selective plugging of gas-injection wells with a chemical formed smoke, as carried on by the bureau, at Franklin, Pa.

Exhaust gas for injection . . . Injection of engine exhaust gas in secondary-recovery operations was discussed by J. M. Breston and R. C. Neal, Pennsylvania Grade Crude Oil Association, Bradford, Pa., and H. Bohne and J. C. Waterman, Thornton Co., Wellsville, N. Y. One phase of the investigation involves the conditioning and injection of engine-exhaust gas into a water flood. This gas, composed mostly of nitrogen, is available without cost, an important factor in some areas where the cost of natural gas is threatening to shut down secondary-recovery operations.

Proper well completions . . . Success of the recently developed fracturing treatments for well stimulation is largely dependent upon the initial well-completion methods used, according to D. M. Roberson and H. F. Coil, Dowell Incorporated, Cleveland. Such practices as nitroshooting, deepening beyond the pay zone, or failure properly to "clean out" the hole before starting production, they reported, reduce the benefits to be derived from chemical or hydraulic treating.

On Hydrafrac application to oil and gas production in the eastern area, Bob Diggs Brown, Halliburton Oil Well Cementing Co., Flora, Ill., said the most accurate account of wells treated indicate three out of four of the wells are commercially successful.

Plantation to Lay Extension

ATLANTA. — Plantation Pipe Line Co. announced last week that it has decided to extend its 14-in. products line from Baton Rouge another 82 miles from Charlotte to Greensboro, N. C.

C. R. Younts, president of the big common carrier, said the extension is scheduled for completion late this year. Construction cost is estimated at $4,500,000.

Completion of the line, together with the recent addition of new booster stations on three lateral lines, will increase pumpings out of Baton Rouge from about 210,000 bbl. daily to a new total of about 225,000 bbl. daily.

The Plantation facilities serve six southeastern states and are used by 13 oil companies. The company laid an 18-in. line from Baton Rouge to Bremen, Ga., and a 14-in. line from Bremen to Charlotte in 1950-51. The new line parallels the original 12 and 10-in. system laid in 1941.

Microwave Problem

Frequencies are limited, but systems can be designed to permit several firms to use the same one, P.I.E.A. told

F. Lawrence Resen

HOUSTON. — There aren't enough frequencies in the radio spectrum to permit "everyone to use radio for the purposes he desires and in the manner he sees fit."

This is the fundamental difficulty facing the Federal Communications Commission, Edwin L. White, chief of the FCC's safety and special radio services bureau, told the twenty-fifth annual conference of the Petroleum Industry Electrical Association here last week.

This is true in the microwave field, in which pipe-line companies own nearly half of the major systems, but application of high engineering standards by the companies can solve this problem, White said.

Operators of multichannel, point-to-point microwave systems, White said, must be assured of interference-free operation. Exclusive licensing of frequencies is not practical, since in view of the rapid growth in the number of systems, the number of available frequencies soon would be exhausted.

However, White declared, an outstanding characteristic of microwave systems is that the angle of radiation and the angle of reception may be closely controlled. Because of this, the same frequency can be used in the same geographical area by two independent systems without noticeable interference.

By application of the best engineering techniques, White said, it might be possible to assign identical frequencies to several systems in the same area without harmful interference resulting.

White pointed out that there are now about 60 fixed microwave systems more than 50 miles in length and probably 75 to 80 shorter systems. More than 25 of the larger systems are for pipe-line use.

To insure the availability of sufficient frequencies in the future, White said it is imperative for companies concerned to initiate planning now.

Cable sheathing . . . The petroleum industry, because of difficult service conditions, is one of the most severe electric-cable applications, R. C. Graham, Rome Cable Corp., Rome, N. Y., told the P.I.E.A.

Unusually careful attention and selection of cable materials, properties, and design are required for oil-industry work, he said. Graham described some of the newer cable insulations and coverings and outlined their uses. They include:

IGNITION CONTROL used on gas pipe-line compressor stations is examined by H. A. Rhodes, head of communications for Transcontinental Gas Pipe Line Corp., left, and George B. Jamison, regional manager of Crouse-Hinds Co., at the joint meeting of the Petroleum Industry Electric Association and the Petroleum Equipment Suppliers Association. Rhodes was chairman of arrangements for P.I.E.A. and Jamison was in charge of arrangements for P.E.S.A.

. . . Neoprene (polychloroprene) sheathing material. This, Graham said, is tough, resists abuse, and has good heat, flame, and sunlight resistance. It also is resistant to low concentrations of chemical reagents at normal temperatures but lacks adequate resistance to severe gasoline or oil conditions. Neoprene compounds make a satisfactory sheath for most general-purpose wiring jobs.

. . . Silicone rubber silastic insulation, expensive now, has properties which will find oil-industry applications. It is serviceable over a temperature range from —55° C. to 150° C., Graham said. A present problem is to find tough nonmetallic protective coatings other than a glass fiber or asbestos braid, which will perform over a similar range.

. . . Polyvinyl chloride, or its copolymer with vinylacetate, is the best known and a widely used material. It lends itself particularly well to chemical and refinery wiring since it has an inherent resistance to flame, sunlight and weather, inorganic acids, oils, and many chemical reagents.

. . . Polyethylene, a pure hydrocarbon resin, has many advantages for the oil industry. It is resistant to weather, most oils up to temperatures of 50° C., and most solvents other than aromatics. Its electrical properties, resistance to moisture and cold-temperature characteristics are superior to any other now regularly available nonmetallic covering. It should not be used on circuits subjected to heavy or uncontrolled overloads.

. . . Polytetrafluorethylene (Teflon) and fluorinated ethylene (Kel-F) are under development as cable insulations. Costs now are prohibitive, but their anticipated advantages are expected to find applications for them. Their almost complete resistance to all solvents, chemicals, flame, water, etc., plus their excellent electrical and heat characteristics present an attractive picture for hazardous wiring jobs, Graham said.

Merger Planned

American Republics stock sought by Tennessee Gas

HOUSTON.—Tennessee Gas Transmission Co. last week was taking steps to buy a 25 per cent interest in American Republics Corp. and to merge with it Tennessee Production Co., a Tennessee Gas affiliate.

Tennessee Gas is one of the nation's major long-line natural-gas pipe-line companies. American Repubics and Tennessee Production both are oil and gas-producing companies operating principally in the Southwest. Both are headquartered in Houston.

Gardiner Symonds, president of Tennessee Gas and board chairman of Tennessee Production, said Tennessee Gas Transmission Co. contemplates sale of 1,000,000 additional shares of stock. Proceeds will be used to buy up to 25 per cent, or 375,000 shares, of the 1,500,000 outstanding shares of American Republics Corp.

Purchase plan . . . Barber Oil Corp., major stockholder in American Republics, and several other large stockholders, have agreed to sell 176,000 shares, or 25 per cent of their stock, to Tennessee Gas at $65 a share, Symonds said. Tennessee Gas will offer to buy 25 per cent of the shares of all

other stockholders of American Republics at the same price, he added.

All purchases by Tennessee Gas Transmission Co. are contingent upon the sale of its own stock.

The approval of the holders of two-thirds of the outstanding stock of each company will be required to make the merger effective.

On December 31, Tennessee Production owned interests in 509 oil and gas wells on 57,000 acres of producing leaseholds. This was the equivalent of 287 net interest wells on approximately 36,000 net interest acres. It also held 249,000 acres of undeveloped oil and gas leases.

American Republics on December 31 owned interests in producing properties covering 112,224 gross acres and 36,173 net acres on which there were 1,131 producing oil and gas wells. Nonproducing property interests owned by the company totaled 1,594,322 gross acres and 925,740 net acres.

Both American Republics and Tennessee Production are actively engaged in exploration and development.

Safety Requires Work

A good safety record can be chalked up only through the concerted effort of all employes, A.A.O.D.C. clinic told

DALLAS.—"Safety does not just occur. Safety is obtained only when there is a conscious effort by men in the organization to have safety," A. E. Chester, vice president and manager of production, Magnolia Petroleum Co., Dallas, told a group of drilling contractors here last week.

Chester spoke on "What the Oil Companies Want in Safety From the Drilling Contractor" at the eighth annual Drilling Industry Safety Clinic sponsored by the American Association of Oilwell Drilling Contractors at the Baker Hotel April 9-10.

He said, "There is an old adage in safety work that safety must begin at the top level, and the desire to have safety throughout the entire operation must be in the minds of all persons, no matter what their jobs may be. This might be called 'safety consciousness.'"

Keynote of the safety clinic was set by C. E. Archibald, Employers Mutual Liability Insurance Co. of Wisconsin, Dallas, who said "Good safety performance is not to be had easily. A drilling contractor must expect to give considerable personal attention to each major activity under his supervision and nothing short of this personal attention will get the job done."

Safety factors . . . Every drilling contractor, safety engineer, and accident-prevention expert, Archibald said, should always have the following rules in his safety primer.

1. Provide safe drilling equipment.
2. Safeguard all machinery.
3. Place no new equipment or machinery in use unless full attention has been paid to the safety of it, and the crew has been trained to use it.
4. Plan and arrange all drilling operations with careful attention to safety.
5. Maintain a system of regular equipment and tool inspection to discover hazards.
6. Maintain operations under safety-minded superintendents.
7. Train, educate, and stimulate all drilling crew employes to follow safe methods of work.
8. Investigate each and every accident to determine how it is possible to prevent a recurrence.
9. See that the injured employe receives prompt and adequate medical attention, and make a full report as soon as possible to insurance carrier of all injuries.
10. Create a feeling of personal interest in each injured employe by visiting him.
11. Encourage employes to have faith and confidence in your organization.
12. Discourage injured employes from seeking litigation; encourage them to rely upon you, his employer, and the insurance carrier to function properly in the disposition of his claim.
13. Always be certain that new hazards and exposures, new locations of operations, or any changes in methods of operations are reported to insurance carrier.

Other reports during the large sessions on drilling safety were presented by F. Weldon Brigance, A.A.O.D.C. president and executive vice president, Rowan Drilling Co., Inc., Fort Worth; W. C. Morris, Allen & Morris, San Antonio; William P. Clements, Jr., Southeastern Drilling Co., and others.

Hardly a Dual Completion

But this Yates field well of Stanolind Oil & Gas Co. in West Texas does produce from two formations. Stanolind production men were troubled by continued oil seepage in the cellar, so they simply set a separate pump in the cellar, rigged a bracket assembly to the existing polish rod to accommodate an extra polish rod, and began production from the cellar as well as from the Yates sand some 1,000 ft. below. The cellar oil comes from a sand just a few feet below the surface of the ground and is produced at a rate of about 12 bbl. per day.

Costs . . . Garland A. Smith, commissioner, casualty insurance division, Texas Insurance Board, Austin, disclosed that the workmen's compensation premiums for the drilling industry alone are estimated at $10,000,000 annually, based upon the latest payrolls and rates.

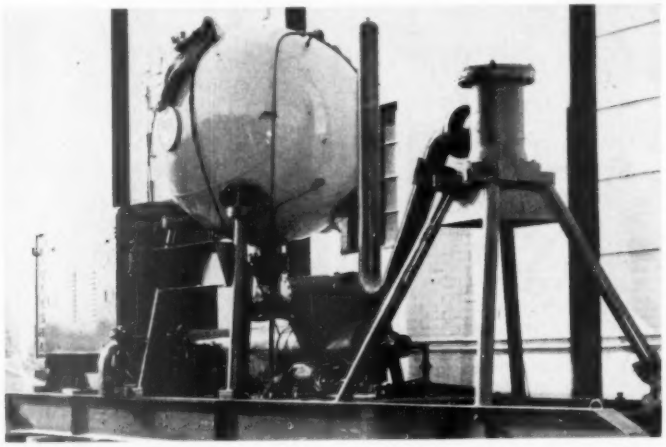
He said that on the estimated ratio of direct or uninsured cost of industrial accidents being four times the indemnity and medical expense paid to the employe, there is a tremendous amount of money being "siphoned" out of drilling contractors' working capital, through injuries to employes alone. This amount, he said, disregards the other possibilities of loss which drilling contractors encounter every day in their activities.

Garland feels it is highly important that drilling contractors get insurance in its proper perspective. Their insurance companies, he said, might be considered a division of one's own business. The charge for this service is built up like any other. In contract drilling, the cost of labor, material, depreciation on equipment, taxes, etc., is taken and the drilling contractor arrives at a rate per foot of hole drilled.

The Texas commissioner said that some have attempted to make excuses for the drilling industry on the basis that their operations are far-flung and therefore not amenable to close supervision by the home office staff. But Garland added, "I hate to disillusion you in connection with this problem but the answer is that all of your em-

ployes and particularly your supervisors, tool pushers, drilling superintendents, and above all, the management (by that I mean the top brass) must understand that the only profitable way to drill a hole is to do it safely."

Prominent A.A.O.D.C.-Dallas safety clinic papers will be carried in full in early issues of The Oil and Gas Journal.



NEW-TYPE PUMP which will be displayed at the I.P.E. this year is this one being installed in National Supply Co.'s exhibit area on the exposition grounds. The pump operates hydraulically. Dominating the picture here is the spherical fluid storage tank.

I. P. E. Guest Plans

Thirtieth-anniversary oil show expected to attract 600 representatives of foreign governments and oil companies

TULSA.—Plans are now being completed for entertaining an expected 600 visitors from foreign countries who will arrive here next month to attend the International Petroleum Exposition.

Dr. O. B. Irizarry, editor of Petroleo Interamericano, Latin-American affiliate of The Oil and Gas Journal, last week said it is expected that 45 foreign countries will be represented at this year's exposition. Irizarry has been named the exposition's executive host for foreign visitors.

"We expect to see about 300 American oil men who are serving with companies operating in foreign countries and at least another 300 foreign nationals, including government representatives, officials of government-operated companies, or nationals working with American or other companies," Irizarry said.

This year's thirtieth-anniversary exposition will open May 14 and continue through May 23. Exposition officials expect it to be by far the biggest oil show ever held, both in numbers of visitors expected and in the number and value of exhibits.

Plenty of room . . . Housing for the guests from abroad, as well as for visitors from other parts of the United States, is expected to be no problem. W. G. Skelly, president of Skelly Oil Co. and president of the I.P.E., last week announced that "ample housing facilities are available for all who wish to attend . . ." Although hotel rooms are allocated, he said, there are "plenty of individual rooms in private homes and entire private homes available." Reservations may be made by writing or wiring the I.P.E. Housing Bureau, 12 West Fourth Street, Tulsa.

TAKING A LOOK at new construction on the I.P.E. grounds are William B. Way, general manager of the exposition, left, and Dr. Oscar B. Irizarry, who will serve as executive general host for the exposition for all visitors from foreign countries.

Irizarry said Oklahoma's Gov. Johnston Murray will move his residence from Oklahoma City to Tulsa during the exposition and will greet all official representatives of foreign governments. It is also planned, he said, that government and oil-company executives from abroad will be met at the airport by exposition officials.

A round of social events also is being arranged for foreign officials and their wives. Events for the women will include a Desk and Derrick Club style show and luncheon, a tea and tour of the city, and a party at Southern Hills Country Club. Company and government representatives will be entertained at a cocktail party and dinner staged by the exposition, a dinner planned by the Nomads organization, and a party at Southern Hills.

"Every courtesy and hospitality will be extended the foreign guests by exposition officials, the Nomads, and by the residents of Tulsa," Irizarry said.

Sun Ends Scrap Drive

PHILADELPHIA.—Sun Oil Co. announced here last week that it has collected an additional 10,508,960 lb. of scrap metal in a so-called "second-look" drive requested by the American Petroleum Institute.

The scrap was obtained principally from dismantling several obsolete buildings, facilities, old condenser boxes, and batch stills. It included such items as steel plate, scrap brass, valves, motors, cable, and old oil drums. The scrap came entirely from Sun's two refineries at Marcus Hook, Pa., and Toledo.

Earlier, the company collected 15,500,000 lb. of scrap in a drive requested by the American Iron and Steel Institute's scrap committee as a pilot operation to develop and test methods which might be used for other refiners in helping to overcome last year's critical steel shortage.

Paul D. Barton, chief engineer for Sun, said that considerably more than the cost of the drive was recovered through the sale of the scrap. In addition, he said, more space for future plant expansion was cleared, and maintenance tasks were simplified.

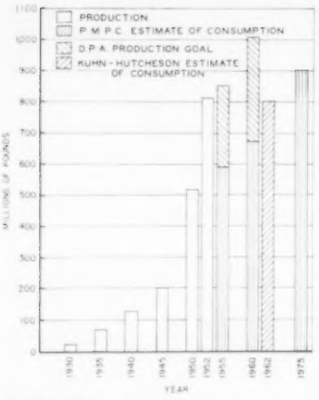


CHART SHOWS production and estimated consumption of ethylene glycol in millions of pounds annually.

Petrochem Pinch

Output of ethylene glycol topping demand, Kuhn says

NEW YORK. — Manufacturers of ethylene glycol need to take a good look at that petrochemical's market situation, according to Dr. Wayne E. Kuhn, manager of The Texas Co.'s technical and research division.

Results of a study completed recently by Kuhn show that production of ethylene glycol, which has struggled in recent years to keep up with demand for the product, now not only has caught up with demand but is in oversupply.

Since it appears, Kuhn said, that some ethylene glycol may not find a market, managements should take immediate action to gage their construction programs with a more critical eye. This could mean curtailing construction of new facilities where possible until demand trends again indicate the need for further expansion, he said. It is also vital, he said, to intensify efforts to find new uses for the product.

Kuhn, who is president-elect of the Commercial Chemical Development Association, said production now is estimated at 810,000,000 lb. annually, as compared with 150,000,000 lb. in 1941 and 600,000,000 lb. in 1951.

Consumption, on the other hand, Kuhn estimates will not reach 800,000,000 lb. annually until 1962. Of this amount, he said, 500,000,000 lb. will be required for antifreeze and about 300,000,000 lb. for synthetic fibers, cellophane, detergents, and other uses.

P.M.P.C. estimate . . . Estimates made last year by the President's Materials Policy Commission are in substantial agreement with these figures, Kuhn said. The commission projected consumption at about 670,000,000 lb. in 1960, not including that going into synthetic fibers, detergents, etc., which, he said, could add another 150,000,000 lb.

More evidence of oversupply is apparent, Kuhn said, in the recent drop in price of ethylene glycol.

Union to Ask Raise

O.W.I.U. expected to seek company-wide contracts

DENVER.—The Oil Workers International Union, principal bargaining agent for oil-industry workers, hopes to achieve company-wide contracts but will negotiate this year "on whatever level we can meet the employers."

This statement was released here April 13 by O. A. Knight, O.W.I.U. president, as the season approached for renewing the bulk of oil-industry labor contracts. Earlier Knight had announced his union generally will seek a wage increase of 7 cents an hour plus additional fringe benefits.

Knight said that while industry-wide bargaining "would not be illogical" since work is similar in all oil companies, he doubted that the union would ever ask for it "in the foreseeable future."

However, he said, the union does believe in company-wide bargaining, particularly in those cases where the union represents "a substantial portion of all the company's employes." "We believe," he said, "that it is no more monopolistic for a labor union to negotiate for the employes of 10 plants within a single company than it is for that company to own and operate 10 plants."

Compared with 1952, the O.W.I.U. 7-cent goal is conservative. Early last spring the union demanded a wage hike of 30 cents at hour, plus shift differentials and fringe benefits. A 5-week strike, directed largely at the Gulf Coast refineries, started April 30 and was called off early in June after contracts were signed with most companies calling for a wage boost of 15 cents an hour and some of the fringe benefits.

In his statement Knight said his union considers plant-by-plant bargaining to be "mechanically ridiculous, aside from any idealogical arguments." "If it is logical for a company to operate a dozen plants in a dozen places, all under the direction of a single office," he contended, "it is logical for collective bargaining to be on the same scope."

New Plant Planned

Monsanto to build giant polyethylene installation

ST. LOUIS.—Monsanto Chemical Co. revealed last week that it is planning construction of a new petrochemical plant which would manufacture 66,000,000 lb. of polyethylene plastics per year when completed early in 1955.

Robert K. Mueller, general manager of Monsanto's chemical division, said capacity of the plant would be expanded 50 per cent by 1957 to total nearly 100,000,000 lb. annually.

Site for the plant, he said, so far has not been chosen pending further study of raw-material sources and future markets.

Mueller said capacity of the plant, Monsanto's first polyethylene-manufacturing venture, would comprise about 20 per cent of projected national capacity in 1957. Production of polyethylene, he said, will make Monsanto the first company to produce the "big six" of plastics materials—the styrenes, phenolics, cellulosics, vinyls, aminoplasts, and polyethylene.

The decision to enter the polyethylene field was based on results obtained from a 3-year research program on high-pressure polymerization techniques conducted at Monsanto's Dayton laboratories, Mueller said. Pressure polymerization has been under study at Dayton since 1939.

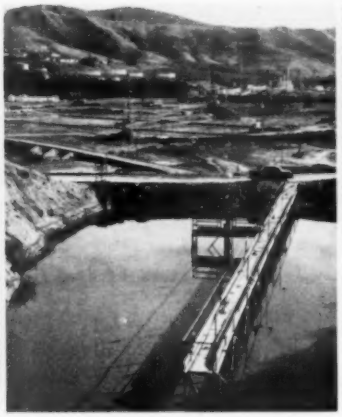
Concurrently with Mueller's announcement, Dr. N. N. T. Samaras, director of the company's research department, revealed that a new high-pressure pilot plant, designed exclusively to permit expanded studies of polyethylene, will go on stream at the Dayton lab late this month.

Industry Briefs

TULSA. — Sunray Oil Corp. will build a new office building here which will accommodate the company's 500 general office employes, Sunray officials announced last week. Size of the building has not been definitely determined, but foundations already specified would accommodate a 12-story structure.

BRADFORD, Pa.—The Joseph Seep Purchasing Agency of South Penn Oil Co. has announced a decrease of 8 cents a barrel in the well price of Corning Grade crude, bringing the posting down to $2.62. The lower price came as the result of an increase of 8 cents a barrel in the pipe-line charges for gathering and transporting the oil. The delivered price at the refinery remains the same.

MUD MINE, on a hillside overlooking the Ventura Avenue field, is operated only as Shell's drilling program requires, or about three or four times annually.



STORAGE RESERVOIR for the clay and water mixture produced by the Dent mud plant is this 100,000-bbl. capacity pit above the central mud plant.

SCREENING of the basic mud to remove any debris is performed as the clay-water mixture leaves the reservoir en route to the mixing tanks.

Shell Mining Own Mud

Clay is sliced from hillside in Ventura Avenue field, mixed with water, screened, blended, and piped to rigs

D. H. Stormont

VENTURA, Calif.—The compactness of Shell Oil Co.'s properties in rugged Ventura Avenue field on the coast of California has permitted the company to use highly unusual drilling-mud facilities in developing the field.

The basic clay used in drilling to the top of the oil formations is mined from the side of a hill overlooking the field. After being ground and mixed with water the mud is stored in a 100,000-bbl. reservoir, from which supplies are withdrawn as needed. Shell and contractor drilling crews requiring a supply of mud of certain properties need only telephone the mud plant and it will be delivered to the rig site through a system which incorporates about 20 miles of pipe.

Shell currently has 15 company and contract rigs at work on its Ventura properties. They largely are engaged in developing the 8,000 to 13,000-ft. D-6 and D-7 oil zones. Much of the drilling is being conducted from multiple-well locations, or "islands," with the holes slanted to the desired target in the pay zone.

General practice followed is to drill from the surface to 700 to 1,000 ft., where surface pipe is set, using local mud which has been treated with small amounts of caustic soda, quebracho, and lignite. From this depth to the top of the producing zone at approximately 7,000 to 12,000 ft. a high pH lime-emulsion mud is used. This mud is treated with caustic soda, hydrated lime, quebracho, and lignite, with oil being added for water-loss control and lubricating purposes.

Before drilling through the producing horizon the lime-emulsion mud is replaced with oil-base mud. In completing the well, if a heavy oil-base mud was used (12 lb. per gallon or over), this first is replaced with a 10-lb. clay mud and then the clay mud displaced with crude oil.

Mining . . . The drilling-mud clay is obtained at the Dent mud plant on the company's Taylor lease. Bulldozers slice the heavy clay from a hillside in huge chunks and push it into the jaws of a grinding mill where it is pulverized and mixed with water. The clay and water mixture then is transported by a 2-mile pipe line to the central mud

MUD MIXING to the properties desired in the finished drilling fluid is carried out in this central plant. Muds are piped from the plant to the rigs through a network of lines.

USED MUD, after it has been contaminated so badly it cannot be reconditioned, is stored in this reservoir.

plant where it is stored in an open 100,000-bbl. reservoir. The mine is operated only three or four times a year, or as the drilling program requires.

Blending . . . Supplies are withdrawn from the huge reservoir as needed and run to central storage tanks. En route to the tanks the mixture is screened to remove any foreign materials. In the tanks weighting material and chemicals are added to convert the mixture to a drilling fluid with the desired properties.

Transporting . . . The mud is pumped to drilling rigs as needed by any of four pumps, two of which are steam powered and two electric-motor driven. When the mud is to be returned to the central plant, connections provided in the mud system at the well permit the rig pumps to do this work.

Oil-base muds likewise are mixed at the central plant but are not piped to rigs. They are delivered and returned by vacuum trucks.

When necessary, the returned mud is reconditioned before it is reused; every possible step is taken to get maximum use from each barrel of fluid. When it has become so contaminated it cannot be reconditioned, the mud is run into a huge open disposal pit.

California Output Rising

LOS ANGELES.—Stimulated by the crude-oil price increase of mid-February, California operators have upped their production until they are within spitting distance of the elusive 1,000,000-bbl. daily mark. Actually they may now be slightly exceeding that level.

During March, according to preliminary estimates of the Conservation Committee of California, the state's fields yielded 999,655 bbl. daily. This was an average of about 7,700 bbl. more than was produced daily during February.

Bulk of the gain was due to increased production in San Ardo field, up about 5,000 bbl. to 31,600 bbl. daily. Kettleman Hills' output was increased 1,000 bbl. to 21,000 bbl. daily.

Of the 1952 discoveries, Union Oil Co.'s Oakridge and Torrey canyon fields showed the greatest gain. These two adjacent fields produced about 5,400 bbl. daily, 1,300 bbl. more than in February.

GULF COAST

Gas Flaring Reduced

New plants, pipe lines reduce gas waste in South Louisiana fields 40 per cent in 18-month period; trend continuing

F. Lawrence Resen

BATON ROUGE.—South Louisiana oil operators have cut their flaring of gas by 40 per cent in the last 18 months in spite of the fact that gas production has increased considerably. And the outlook is for a continuation of the trend.

There are several reasons. Biggest factor is the laying of lines into remote coastal areas by United Gas Pipe Line Co. Construction of several new carbon-black plants has provided a profitable outlet for much of the gas. Also, the increase in the use of gas for injection purposes has helped cut the amount flared.

In August of 1951, for example, a report of 16 operators to the Louisiana Conservation Commission on their operations in 66 fields showed that 206,000,000 cu. ft. of gas was being flared daily. In January of this year, the figure had been cut to 127,000,000 cu. ft. per day.

This amount soon will be cut to 100,000,000 cu. ft. with the completion of two new petrochemical plants, a gasoline plant, and a connecting pipe-line system.

In these projects The Texas Co. will build a gathering system to serve several fields in Terrebonne and Lafourche parishes and move the gas to a gasoline plant being built at Paradis, in St. Charles Parish. From here the residue gas will be transported to the plants of American Cyanamid Co. and Lion Oil Co. now under construction near New Orleans *(The Oil and Gas Journal, March 16, page 169).*

In total, the Texaco line will move 40,000,000 cu. ft. daily from South Louisiana fields, with 27,000,000 cu. ft. coming from the fields reported on by the 16 operators.

Conservation examples . . . The reduction of 40 per cent in the flared gas actually does not illustrate the full increase in gas utilization, since in most fields gas production has increased during the period.

In August 1951, for example, The California Co. flared 209,000,000 cu. ft. from Delta Farms field. This January, however, only 6,000,000 cu. ft. was flared. This would indicate a net increase in gas utilization of 203,000,000 cu. ft. Total gas sales of the company during January, however, were 868,000,000 cu. ft.

Greatest single cut in flaring was effected by Tide Water Associated Oil Co. in Venice field. Here the company decreased its flaring from more than 15,500,000 cu. ft. per day to almost nothing by tying into United's new pipe-line system.

The general reduction in flaring also is notable because many of the South Louisiana fields are located in remote marsh lands a considerable distance from markets. In spite of the difficulties and expense involved in laying gathering systems, projects to utilize the produced gas are under way, and the companies have been commended by John B. Hussey, Louisiana conservation commissioner, for their efforts to reduce the waste of gas.

Higher Taxes Proposed

JACKSON, Miss.—Mississippi's Gov. Hugh White has come out in favor of an increase in oil and gas severance taxes.

The oil-severance levy, White said, should be increased from 6 to 8 cents per barrel, with a similar increase in the gas tax.

A bill providing for higher taxes is expected to be introduced shortly in the state legislature.

A BARREL OF BLUE

TO STOP LOSSES LIKE THIS

Rolling Tanks

ROLLING tanks or taking price penalties on high BS&W oil are costly nuisances you can eliminate when you put Visco to work on your leases. You get the uniform, high-quality Visco formulas best suited to produce dry oil at lowest cost—PLUS the recommendations and assistance of your Visco Field Service man, available 24 hours a day, every day, to help you.

If you have an emulsion-breaking problem now, call Houston, CAPITOL 7300, collect, for fast action...Might be wise to call even if you are not in trouble....No one ever got fired for saving his company money on treating costs.

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CONSISTENTLY EFFICIENT DEHYDRATING AND DESALTING CHEMICALS

Civil Suit Planned

Justice Department says civil antitrust complaint will be filed against companies involved in FTC cartel charges

Bertram F. Linz

WASHINGTON. — The Department of Justice announced April 9 it will file a civil antitrust suit in the international cartel case instituted last year by the Truman administration.

It did not announce what action it would take regarding criminal complaints now pending but said a department attorney would present the Government's position in District Court here April 28, the expiration date of the 3-month delay granted by Judge James R. Kirkland to enable the Eisenhower administration to review the matter.

The department said it will follow its civil suit with a request that the companies involved be directed to produce documents in this country relating to their foreign operations abroad and the effect of those activities on this country's foreign commerce.

The grand jury investigation of the activities of American oil companies operating abroad was based on a Federal Trade Commission staff "study" purporting to show that they had participated in an international cartel to divide markets, maintain prices, and in other ways control the world oil trade. It was instituted by former Attorney General Harold McGrath at the direction of President Truman.

In January, shortly before the change of administration, Truman instructed McGrath's successor, James P. McGranery, to terminate the proceedings provided the companies agreed to produce documents relating to their activities which had been subpoenaed by the Department of Justice. The companies refused to agree to those terms and the case was left in the lap of the incoming administration.

Abandonment of the grand jury investigation which never really got under way although it was scheduled to start in September was decided upon on the recommendation of the National Security Council but that body, reportedly, did not suggest that submission of documents be made a condition.

Departments opposed . . . The Truman attack on the oil companies never had the support of the State, Defense or Interior Departments. State Department officials feared that the investigation would have adverse effects upon our relations with foreign countries, as in fact it did.

Defense officials viewed the matter from the standpoint of national defense and possible military oil supplies from the Middle East. Interior Secretary Oscar L. Chapman disagreed with the FTC conclusions that the activities of the American companies abroad resulted in inadequate reserve producing capacity in this country and said so vigorously in a letter to Leonard Emmerglick, special assistant to the attorney general, who was in charge of the case.

Judge Kirkland, who has been impatient of the delays caused by the steps taken by the companies to resist the department's demand for documents, indicated in January that he was suspending the case only because of the change in administration.

Imports Debate

Clamor for quota on oil expected at trade hearing

WASHINGTON.—The House ways and means committee will open hearings on extension of the Reciprocal Trade Act next week, and the major issue to come before it will be that of a quota on oil imports.

Independent oil producers and refiners, the coal and railroad industries, and organized labor will join in the demand that a curb be imposed on the importation of foreign crude and residual fuel oil.

Administration officials, however, will ask that the law be continued for a year without change, so that a thorough study can be made of the act, its effects on domestic industries, and the type of changes needed.

Well over a score of bills calling for a quota have been introduced in Congress, most of them by members from the coal-producing states who seek to limit imports of residual fuel to 5 per cent of domestic demand.

Carlson bill backed . . . While the independent producers and refiners would not fight such a bill, they are reported to favor a measure introduced by Sen. Frank Carlson of Kansas to limit imports of crude and products to 10 per cent of domestic demand with provisions for suspension of the quota in the event the President should find there is a shortage of oil in this country.

Spokesmen for the independent groups explain they feel the best way to handle the import problem would be through voluntary restrictions on the part of the importing companies. But Russell B. Brown, general counsel of the Independent Petroleum Association of America, expressed the belief the companies may be unable to take action because of antitrust implications.

A spokesman for the Independent Refiners Association of America, however, said that, after conferences with officials of some of the importing companies, he was hopeful that the problem could be worked out without legislation. Some companies, he said, already are cutting imports.

Avgas Exports Cut Sharply

WASHINGTON.—Exports of major oil products averaged 221,200 bbl. daily during the week ended March 13 compared with 226,600 bbl. daily the preceding week, according to figures compiled by the Petroleum Administration for Defense.

A sharp cutback in shipments of aviation gasoline from the exceptionally high level of the week ended March 6 was largely offset by increases in the other four products.

Details of the week's movement, compared with the preceding week, and averages for the 4 weeks ended March 13 are shown in the accompanying table, in thousands of barrels daily.

	Week ended		Average
	March 13	March 6	4 weeks
Aviation gasoline	22.2	77.7	36.1
Motor gasoline	18.5	11.7	31.3
Kerosine	23.4	0.9	11.9
Distillate	105.9	92.7	99.7
Residual	51.2	43.6	56.2
Total	221.2	226.6	235.2

DPA Extension Endorsed

WASHINGTON. — A 2-year extension of the basic provisions of the Defense Production Act was recommended last week by the Senate Banking Committee.

Legislation sent to the floor for action would give the administration the powers which Interior Secretary Douglas McKay and other officials urged

to make possible the continuance of the industry expansion programs now under way.

In one respect the committee failed to go along with McKay's suggestions. It refused to eliminate the Bow amendment prohibiting the federal Government from imposing restrictions on the distribution of natural gas in states which certify they have themselves undertaken such responsibility.

Tidelands Talkathon

Minority group in Senate will attempt to delay bill

WASHINGTON.—A small but vocal minority in the Senate threatens to delay final action on tidelands legislation for maybe several weeks.

Admittedly without any expectation of defeating the measure, which would recognize the coastal states' rights to the submerged resources within their historic seaward boundaries, a small group of senators last week prepared to start on a "talkathon."

As the debate got under way the majority floor leader, Sen. Robert A. Taft of Ohio, said that from now on the Senate will meet 5 days a week instead of 3 as heretofore and that the tidelands legislation would not be laid aside for any other important bill. His comment apparently disposed of a suggestion that the measure be set aside so that extension of the Defense Production Act could be disposed of well in advance of April 30.

The Senate measure deals merely with the oil and gas rights in the coastal belt within the long-recognized boundaries of the states and leaves administration of the Continental Shelf reserves for future consideration.

The House passed a bill April 1 dealing with both the coastal belt and the Continental Shelf, returning the former to the states and reserving the latter in its entirety to the federal Government. The bill established a basis on which development of the Continental Shelf could start almost immediately, but made no provision for giving the states a share in the revenue from the Continental Shelf, either directly or through imposition of severance or production taxes.

It is not expected that any effort will be made to have the Senate adopt that bill in place of its own measure, but that question may come up when the legislation goes to a conference committee which will have to decide whether to postpone a decision on the handling of the Continental Shelf or accept the House idea of disposing of both the inshore and Continental Shelf problems in one package.

WATCHING WASHINGTON

Bertram F. Linz

Wanted: New PAD Chief

For the third time in 30 months the hunt is on for a top-ranking oil man to serve as head of the Petroleum Administration for Defense.

Within the next 7 weeks Interior Secretary Douglas McKay will have to find a man to succeed Deputy Petroleum Administrator J. Ed Warren, who plans to leave June 1 to return to industry after a European vacation.

McKay has said he wants the industry to come up with the names of some men of the same caliber as Warren and Bruce K. Brown, first head of PAD, who can be persuaded to take a job that nobody seems to want. Brown came from the major companies and Warren from the independents, but apparently the next man can come from either group.

As things are shaping up now, PAD will be a very small organization after June 30 and will have only a few problems to deal with. But any sudden shift in the international situation could overnight make it fully as important as it was originally when it appeared that the United States might be on the threshold of a major war.

Truce Won't Affect Oil

The possibility of a truce in Korea is coloring the thinking of administration officials and industry executives alike, but so far there is no agreement on what will happen if hostilities actually do end.

One thing, however, does appear certain. The Government has no intention of permitting a truce to halt the mobilization program, and the oil industry will be asked to go ahead with its expansion of crude availability, refinery capacity, and transportation facilities.

There are two reasons for this. One is that current Red moves may be designed to lull the West into a feeling of false security and possibly split the present NATO concerted front. The other is that the administration wants to keep industry moving at its present pace to avert a recession that might occur if military spending suddenly slowed.

Peace in Korea would strengthen the demand for tax cuts, possibly even greater than the administration now is becoming resigned to accepting. But there is no great indication that it would make the job of balancing the budget any easier.

A Korean truce would not result in any immediate large cutback in military oil requirements. Until a real peace is obtained, it would be necessary to keep large forces in the Far East, and fuel savings would not be substantial.

Observers in Washington believe that, even if a truce is secured, the administration will go ahead with its present plan to retain the emergency defense agencies, including the Petroleum Administration for Defense, and carry to completion all of the present industry expansion programs.

Public-Lands Dissension

Transfer of the Bureau of Land Management to the Department of Agriculture as part of a plan for reorganization of the Interior Department will be opposed vigorously by congressional delegations from the public-lands states.

Advised that such a proposal would precipitate a bitter fight, President Eisenhower has assured Sen. Pat McCarran of Nevada and other western senators that he will confer with them before making a final decision to transfer the agency.

The bureau is charged with the management, leasing, and disposal of the vacant public lands and their resources, and administers the mineral-leasing laws on lands in the public domain and purchased lands under the jurisdiction of various federal agencies.

The Department of Agriculture also has a bureau of land management and the Forest Service, and it has been proposed that all three be merged into one agency which would have practically complete control of all government-owned lands. The public-lands states oppose the plan on grounds that agriculture has had no experience in handling oil and mineral resources.

Transfer of the Bureau of Land Management would be an abandonment of the century-old policy of making the Interior Department responsible for the management, conservation, and development of the natural resources of the nation.

LATIN AMERICA

Creole Report

Venezuelan Government netted more from operations of the company last year than Creole did, annual report shows

CREOLE PETROLEUM CORP. last year paid the Venezuelan Government a total of $224,374,000 in royalties, income, and other taxes—an amount slightly greater than the net income of this leading Venezuelan company.

The figures show the effect of the 50-50 profits-division policy under which the Venezuelan Government deals with the oil companies. Creole's 1952 net income was $220,931,000. The previous year, Creole had a net of $202,278,300 and paid the Venezuelan Government a total of $206,776,000.

Creole's report revealed that last year the company operated an average of 33.8 rigs. Of these, 7.7 were on exploration, the lowest such average since 1944. On the other hand, the average 26.1 development rigs compared with 9.1 in 1951, 6.1 in 1950, and 13.1 in 1949, and 25.4 in 1948. Total exploration footage at 234,259 ft. compared with 625,116 ft. in 1951 and was the lowest since 1947. Development footage of 1,805,740 ft. was more than double 1951 and was the highest on record.

Drilling record . . . Creole's net production plus purchased royalty last year averaged 803,407 bbl. daily, highest in its history and 44.5 per cent of the total for the Venezuelan industry. Of the 329 wells drilled by Creole and its partners, 285 were oil producers, one a gas well and 43 dry.

The company completed 14 wildcats compared with 7 in 1951. Of the 14, 6 were completed as oil producers in new fields or reservoirs, and 1 was a gas well. In addition, Mene Grande, on jointly held acreage, drilled 14 wildcats of which 8 were producers. Drilling costs were slightly lower in all areas except Bolivar Coastal where there was a slight upward trend due to the use of more expensive completion method requiring screen liners.

In Bolivar Coastal field of Lake Maracaibo, Creole stated it had completed a new plant to fabricate square solid concrete piles 200 ft. long, larger than any piles made elsewhere in the world. Use of the piles was made necessary by the extension of the Lake fields into deeper water. Describing its program to utilize oil-associated gas, the company said projects completed or planned during 1952 will enable the processing or consumption in its own plants of about 200,000,000 cu. ft. in addition to the 102,000,000 cu. ft. previously being handled.

Creole reported it is participating with Shell Caribbean Petroleum Co. in the construction of a new 28-mile, 8-in. products line. This Carabobo line will extend from Puerto Cabello to Guacara, near Valencia, serving a market area second in importance in Venezuela only to Caracas.

Financial . . . The Creole report also gave significant information on labor costs. For its average 14,700 employes last year, the company paid out $63,906,000 in payroll charges and another $45,687,000 in other costs, the largest item of which was bonus and termination costs under the labor law and contracts, $16,160,000. Creole thus had an average cost per employe last year of about $7,450, a slight decrease from the corresponding figure for 1951. Gross plant investment per employe last year was $59,600.

Last year, Creole sold a total of 291,615,934 bbl. of crude and refined products for an average realization of $2.20 per barrel, compared with $276,341,006 bbl. at $2.17 in 1951. The company disclosed that its Venezuelan income tax returns for the years 1943 through 1947 have been inspected and some deficiencies alleged. "While part of the alleged deficiencies have been settled, there still remain some which are under discussion with the fiscal authorities, and others which are before the courts," it said.

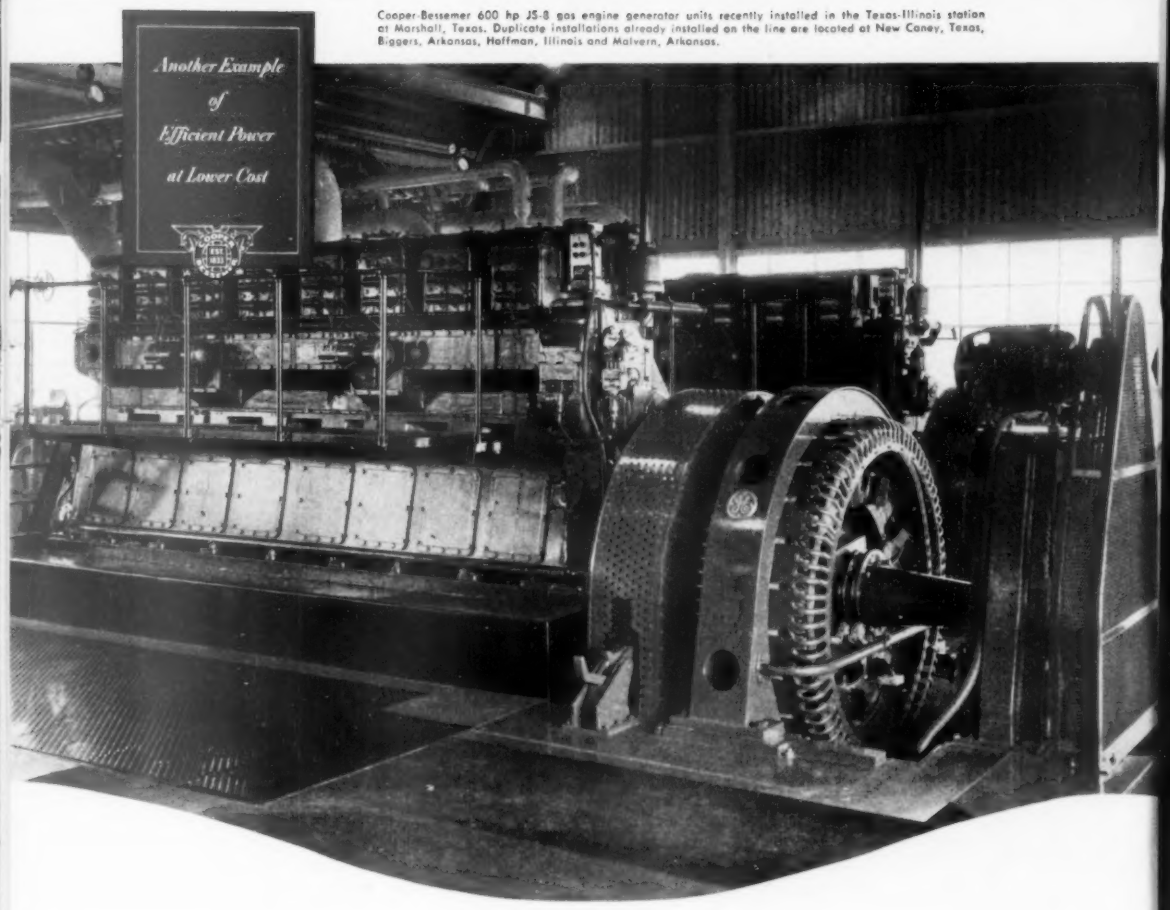
Argentina Ends Rationing

Argentina has ended gasoline rationing which was placed in effect in January of last year.

The Commerce Ministry of the Government cited "ample public cooperation" and increased supplies in its an-

Old Tanker Undergoes Modernization

An unusual tanker modernization job was carried out recently by Standard-Vacuum Oil Co. in a German shipyard at a cost of approximately $2,500,000. The 13-year-old ship of 15,345 dwt. was cut apart and the bow and stern were then grafted to a new 300-ft. cargo section. Here the old cargo section, right, is shown tied along the new section prior to the transfer of midship housing, addition of old bow and stern, and renaming of the rebuilt vessel as the Stanvac Nairobi. The "new" tanker has a capacity of 144,000 bbl. and 30 ft. more length than the old ship. It will be used in the Far Eastern trade.



Cooper-Bessemer 600 hp JS-8 gas engine generator units recently installed in the Texas-Illinois station at Marshall, Texas. Duplicate installations already installed on the line are located at New Caney, Texas, Biggers, Arkansas, Hoffman, Illinois and Malvern, Arkansas.

24-YEAR PROGRESS WITH COOPER-BESSEMERS

on the Texas to Illinois Lines

SHOWN here are some of the latest Cooper-Bessemer gas engine generating units installed in Texas-Illinois Natural Gas Pipeline Company's new pipeline. Modern JS's like these have now gone into five Texas-Illinois stations; will likewise power 4 more new stations as the year goes on.

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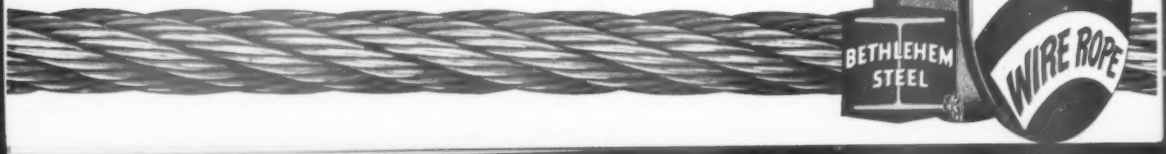

nouncement abolishing the rationing program April 4.

Automobiles had been limited to 7½ gal. a week, but many service stations had cut customers to half the official ration in an effort to preserve their own supplies.

The imposition of rationing nearly a year and a half ago was tied into the loss of supplies from Iran which the Argentines had been receiving under their reciprocal-trade agreement with Britain. Late last year, Britain and Argentina reached an agreement renewing their trade-exchange pact with provisions for the supply by Britain of crude and fuel oil amounting to an average of around 80,000 bbl. daily.

New Pemex Plant

Agency planning refinery to process heavy crude oil

PETROLEOS MEXICANOS is considering plans for the construction of a new refinery at Tampico in the State of Tamaulipas.

The proposed new refinery would be designed to handle heavy crude, including that produced at Tenixtepec, Naranjos, and Panuco fields. The project envisages a pipe-line connection from the plant to Monterrey, according to reports from Mexico City.

The three existing refineries in the Tampico district all date from pre-expropriation days and have been little improved since. Their aggregate capacity is about 110,000 bbl. daily, but runs are considerably below this. Much of the equipment is considered completely worn out. Largest is the Cuidad Madero refinery with a rated capacity of 71,000 bbl. daily, built originally by Shell.

Per-barrel processing costs at Tampico are more than double what they are at the newest Pemex refinery at Salamanca. The difference is attributed to the age of the equipment.

Pemex also has plans for modernization of the Isthmus refinery at Minatitlan. This plant, now charging around 20,000 bbl. daily of local crudes, will be boosted to a 40,000-bbl. daily throughout. The topping facilities will have to be rebuilt, and a 7,500-8,000-bbl. catalytic cracking unit installed.

Long-range refining plans of Pemex also provide for the construction of three new 10,000-bbl. daily refineries on the West Coast. These are expected to be located at Guaymas, Salina Cruz, and Mazatlan. Crude would be supplied by tanker after moving across the trans-Isthmus pipe line.

The recent annual report of Pemex said that the capacity of the Atzcapotzalco refinery in Mexico City would be increased from 50,000 to 80,000 bbl. daily during the current year with the completion of additional pipe-line capacity from Poza Rica. Capacity at Salamanca also will be raised from 30,000 to 40,000 bbl. daily during the year, while throughput of the Reynosa plant will be brought to 7,000 bbl. daily.

Refinery Nearing Completion

Work is now 75 per cent completed on a new 28,300 bbl. daily refinery being built by Yacimientos Petroliferos Fiscales near Buenos Aires.

The refinery was designed by M. W. Kellogg Co. and is being constructed by Y.P.F. under the supervision of Kellogg Pan American Corp. Facilities will include fluid catalytic cracking, alkylation, and one of the world's largest delayed coking units.

The refinery will have two crude units, one of 21,000 bbl. daily capacity, and the other charging 7,300 bbl. daily. Other major process equipment comprises thermal cracking, straightrun gasoline fractionation, vacuum distillation, and catalytic polymerization.

In order to obtain the desired number of welders and other specialized construction men needed for the project, training schools for the development of the precision methods required to fabricate and erect the refinery equipment was established.

Location of the new refinery is at Eva Peron, formerly called La Plata. The plant itself will be known as the Presidente Peron refinery, serving primarily the Buenos Aires market. Last year, Y.P.F. constructed a 35-mile products line with a capacity of about 18,800 bbl. daily from the Eva Peron to Buenos Aires.

Talon Seeking Higher Output

New drilling will be undertaken in the Mene de Mauroa area in the western Venezuelan states of Falcon and Zulia by Talon Petroleum Co., C. A., which last year bought out the former operator, British Controlled Oilfields, Ltd.

Talon, which has a capital of about $3,000,000, is considering reworking existing wells and deepening others in an attempt to develop Cretaceous production.

Talon was organized with capital supplied by Clint W. Murchison, Dallas operator; George Ohrstrom Associates, New York; Cecil V. Hagen, Houston, president of Manabi Exploration Co. which operates in Ecuador; and Roy B. Kelly, Washington attorney. Ohrstrom is president of Talon, and A. D. Cheek is resident manager at Mene de Mauroa. B.C.O., which drilled an unsuccessful deep Cretaceous test in the area several years ago, had a production of about 1,000 bbl. daily.

Creole Production Down

Creole Petroleum Corp.'s operated production in February fell another 12,597 bbl. daily to an average for the month of 709,969 bbl. daily. The company's output hit a record in December, but declined nearly 81,000 bbl. daily in January.

The February production consisted of 576,034 bbl. daily from Lake Maracaibo, 6,099 bbl. daily from other western Venezuela fields, and 127,836 bbl. daily from eastern Venezuela. February refinery runs were 60,474 bbl. daily at Caripito and 49,894 bbl. daily at Amuay.

During February, Creole operated an average of 21.2 rigs and drilled 13 wells of which 11 were completed as oil producers. There were three successful exploratory wells, in Maracaibo, San Joaquin, and Pilon.

AFRICA

Companies May Enter Libya

Several large oil companies are showing an interest in the possibilities of engaging in exploratory work in Libya, North Africa.

Reports are that preparation of basic petroleum legislation in the country now is under way. Companies understood to have made tentative investigations of the possibilities are Shell, Anglo-Iranian Oil Co., Ltd., Standard Oil Co. (N. J.), and Conorado Petroleum Corp.

Libya, lying to the west of Egypt, has a total area of some 1,100,000 sq. miles.

Libya is one of the world's poorest and most backward regions, with a per capita income estimated last year to be $35. Exploratory work was undertaken in the western desert of Libya's eastern neighbor, Egypt, shortly after the war by Jersey Standard but later discontinued. These efforts were hampered by numerous unreclaimed land mines laid during the North African campaigns.

Mozambique Test Planned

Mozambique Gulf Oil Co. has carried its first well in Mozambique to about 8,700 ft. and is preparing to move to another location for a second shallow test.

The wells are a part of a six-hole program in the southern part of the company's concession in this Portuguese East Africa territory. They are de-

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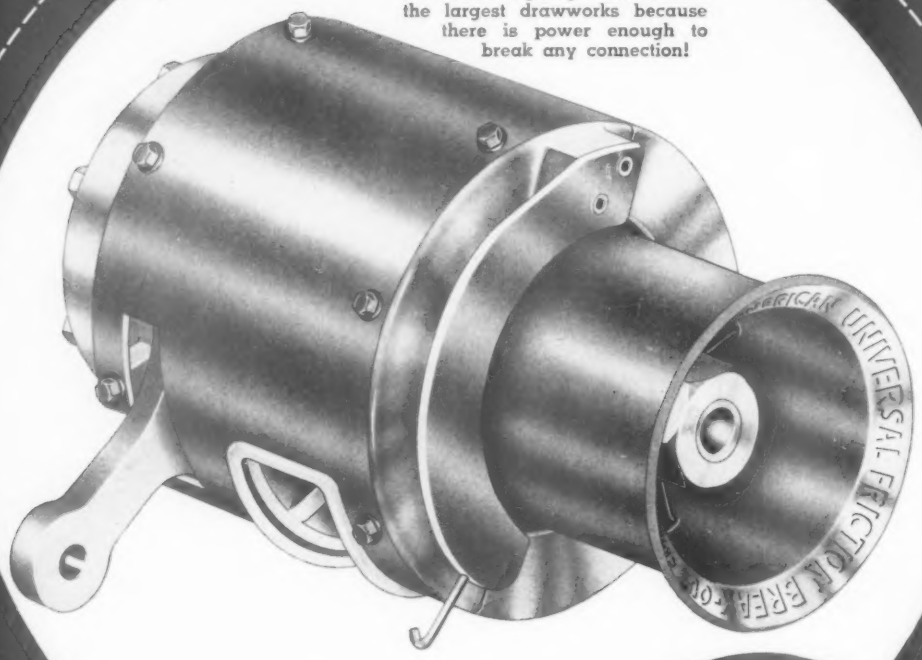

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scribed as stratigraphic tests. The first well was bottomed in the lower Cretaceous, and the depth reached about the maximum for the National 75 rig being used.

The first well was located about 20 miles west of the coastal port of Inhambane while the second location is about 45 miles southwest of Inhambane near the town of Inharrime.

Across the Magadascar channel, a French-controlled company is now drilling its third test in the southeastern part of the island. This test is located near the village of Leoposa about 8 miles southwest of Ranoshira and some 125 miles east and north of Tulear. The other two wells are in an area about 50 miles southeast of Tulear. One was taken to about 8,850 ft., and the other to about 8,700 ft.

The French company holds rights over all the island. However, Standard-Vacuum has made geological studies of Magadascar's prospects for possible joint operations.

EUROPE

Italian Surplus

Greater capacity, coupled with local consumption of fuel oil, leaves refiners with worry of excess light products

Dahl M. Duff

ITALIAN refiners are pressing the Italian Government for assistance in developing export markets because of an increasing surplus of light products which will otherwise force a reduction in refining activity.

Import, refining, and consumption figures on Italian oil operations show that the domestic market is using the entire refinery production of fuel oil but is left with a burdensome excess of the so-called white products.

The situation is due in part to the sharp increase in Italian refining capacity last year. On December 31, 1952, total capacity in Italy was placed at 13,400,000 tons, or about 268,000 bbl. daily, compared to about 200,000 bbl. daily a year earlier and to only about 124,000 bbl. daily on December 31, 1950.

The expansion in Italian refining has brought the total investment in this activity up to the lire equivalent of about $366,000,000. When the estimated $32,000,000 invested in the tankers owned by the Italian industry is added, the total comes to nearly $400,000,000.

During 1952, the Italian refineries processed approximately 8,200,0000 tons, or about 164,000 bbl. daily of crude oil. Production from these runs included:

Product—	Quantity (in metric tons)	% change from 1951
Motor gasoline	1,552,498	+15.25
Kerosine	551,058	+18.21
Gas oil	1,610,153	+14.96
Fuel oil	3,986,918	+17.90
Lubricants	67,445	−24.50
Asphalt	275,014	+35.20

The following figures show last year's major oil imports and exports of Italy:

IMPORTS

Product—	Quantity (in metric tons)	% change from 1951
Crude	8,850,000	+20.67
Motor gasoline	16,000	−54.70
Kerosine		
Gas oil	4,200	−80.30
Fuel oil	280,000	−58.50
Lubricants	38,000	−48.00
Total	9,188,200	+12.89

EXPORTS

Motor gasoline	650,000	+48.76
Kerosine	330,000	+87.50
Gas oil	540,000	+43.62
Fuel oil	980,000	+163.45
Total	2,500,000	+83.69

During 1952, the larger part of the crude used by Italian refineries came from Saudi Arabia, which supplied 4,600,000 tons. Iraq supplied 1,890,-000 tons, and about 2,100,000 tons came from other Middle East countries, including Kuwait. Much of the 2,500,-000 tons, or about 50,000 bbl. daily, of products exports were out of the Naples refinery of Socony-Vacuum Oil Co., Inc.

Italian refining capacity is rising even further during the first part of this year. The new Condor refinery at Rho near Milan is coming on stream, and the facilities of the Venice refinery of IROM (AGIP and Anglo-Iranian) are being expanded. Large-scale exports, particularly of the lighter products, must be made if the entire Italian refining industry is to operate at anything like full capacity. This is further shown in the data on domestic Italian consumption in the following table.

Oil refining activity has assumed an important place in the Italian economy. This is made even greater by the impact of the tanker traffic on the country's commerce and shipping. For example, last year, oil exports and imports made up 89 per cent of the total traffic in the port of Bari, while in port of Naples the figure was 81 per cent against 65 per cent in 1951.

	Quantity, metric tons	
Product—	In 1952	In 1951
Aviation gasoline	32,000	30,000
Motor fuel	878,000	780,000
Kerosine	220,000	204,000
Gas oil	1,071,000	906,000
Fuel oil	3,080,000	2,930,000
Lubricants	139,000	127,000
Other products	243,000	218,000
Total	5,663,000	5,195,000

Italian quarters are citing these facts to explain the current efforts of various Italian interests to work out imports of oil from Iran. Rumors persist that well-known and important Italian industrialists are behind these Iranian export attempts. These interests are said to be now working through small import-export companies to avoid compromising themselves until the whole Iranian situation is cleared up.

MIDDLE EAST

More Tankers Leave Iran

Two more tankers were scheduled to dock in Italian ports late last week with cargoes of Iranian oil.

The vessels are under charter to the the Iranian company, Supor. The company was keeping their actual destinations secret in the hope of unloading them before legal action could be taken by Anglo-Iranian Oil Co., Ltd.

One of the ships was the Miriella, which carries about 4,500 tons, or around 30,000 bbl. The other was the Alba, of approximately twice the capacity. Both loaded Iranian oil last month.

The Miriella was the first ship to carry Iranian oil to Italy. In February Anglo-Iranian lost in an effort in an Italian court to have this cargo impounded, but is continuing a legal fight to establish ownership. Anglo-Iranian is expected to press its claims against the new two shipments as soon as possible.

In Teheran, Francesco Mortillaro, managing director of the Supor company, said recently that four more large Italian tankers will arrive in the Persian Gulf during April to take on Iranian oil.

Price Cut Termed Sound

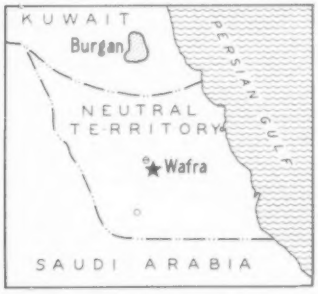
Suppliers of crude oil in the Persian Gulf last week apparently were going along with the action of Anglo-Iranian Oil Co., Ltd., in dropping the price of

Kuwait oil by 15 cents because of quality.

No further price changes had been made, and there was a general agreement that Anglo-Iranian's step was sound. An official of one major company commented that the 15-cent quality differential established by Anglo-Iranian was "within a cent of what we thought it ought to be."

The new $1.50 price for 32°-gravity Kuwait oil was announced April 1, and at first there was speculation over the possibility of a general price drop in the Persian Gulf if the other companies felt that their competitive position was threatened.

The quality differential for Kuwait crude is based on its higher sulful content and lower yield of light products. Kuwait crude—as well as that from Fao in Iraq—requires a slightly longer tanker haul up the Persian Gulf. However, since tanker rates elsewhere throughout the world are on an area basis, a price concession for this difference has never been recognized by Anglo-Iranian.



NEUTRAL ZONE discovery is indicated by star. Symbol just above shows location of 2.3-mile stepout to be drilled next, and circle at lower left is location of wildcat the company plans to drill to test the Arab zone. Reservoir conditions in the discovery are similar to those in Kuwait's famous Burgan field, directly to the north.

Discovery Testing

Neutral Zone wildcat flows 4,500 bbl. from two sands

AMERICAN INDEPENDENT OIL CO.'s discovery well in the Kuwait-Saudi Arabia Neutral Zone last week flowed at a rate of 2,500 bbl. daily in a drill-stem test of the First Burgan sand and 2,000 bbl. daily from a second productive sand below the Orbitolina limestone.

The tests were made using a 5/8-in. bottom-hole choke and a 1½-in. top-hole choke.

A 24-hour flow test was scheduled for the week end.

Company officials indicated the significant discovery might be put on production as a dual completion. If this proved too difficult, however, it was expected that the fluid from both productive zones would be mixed and both produced through the tubing.

As soon as the discovery well is completed the company plans to move the rig to a location 2.3 miles to the northwest on what is indicated by a seismic survey to be the high of the structure.

In spite of the fact the company had already spent about $30,000,000 in its drilling program and had drilled five dry holes, company officials last week were enthusiastic about Neutral Zone prospects. Porosity found in the Arab zone suggests quite favorable prospects for several other structures in the area which had been considered not too promising and has changed some geological concepts, a company official said. In nearby Burgan field the Arab zone is hard and tight. Plans are made to test the Arab in a structure in the southwestern portion of the zone sometime in the near future. This test was to have followed the drilling of the Wafra 4, now being tested, but was postponed in favor of developing the Wafra pool.

International Briefs

The well Cuarto Poder, located at Angostura in the State of Veracruz, has turned out to be noncommercial, according to officials of Petroleos Mexicanos. However, two new rigs are being sent to the zone in an effort to realize at least part of the hopes originally expected from this area, which is about 42 miles from the Gulf Coast port of Veracruz.

D'Arcy Exploration Co., Ltd. (Anglo-Iranian) has begun exploratory work for oil at Rafcliffe-on-Trent in England. Oil was discovered in small quantities in the area recently during routine drilling of an exploratory nature by the British National Coal Board.

The first gas-turbine-driven pumping unit to be used in Kuwait is to be installed shortly at the newest oil gathering station of Kuwait Oil Co., Ltd. The 1,000-hp. unit, made by Ruston Hornsby, Ltd., British manufacturer, will be operated on oil-field gas, but with little alteration it can be run on a variety of fuels. The turbine's operation will be studied for its suitability for use in pipe-line pumping stations.

Further encouraging oil shows, along with some high-pressure gas, have been found in the Naharkatiya test of Assam Oil Co., Ltd., in Northeast India. The well has reached 10,016 ft. Casing is being set, and preparations are under way for deeper exploration.

The French company, Raffineries Francaises de Petrole del'Atlantique, has been licensed by American Development Corp., New York, to install ADC's electrolytic caustic regeneration process at its Donges refinery in France. The process will regenerate the caustic soda employed in treating operations at R.F.P.A.'s 35,000-bbl. refinery which will operate on Middle East crude oil.

French oil and gas-producing companies have been given a depletion allowance in the new finance act passed by the French Parliament. The allowance, long sought by the French companies, is patterned after that in the United States with exemption allowed on 27½ per cent of the gross from sales, provided it does not exceed 50 per cent of the net receipts. However, the French legislation requires that the sums exempted must be reinvested within 5 years in exploration or development in France or its overseas territories. Amounts not reinvested are liable to taxation at the current rates.

Esso Export Corp. April 2 increased the price of Bunker C fuel oil 10 cents a barrel on cargo shipments, f.o.b. Aruba, N.W.I. The new price of $1.60 a barrel follows the recent strengthening of the Gulf Coast residual fuel-oil market.

Anglo-Iranian Oil Co., Ltd., has improved its oil-handling facilities at the Llandarcy refinery in South Wales by laying six new lines between the plant and Queen's Dock at Swansea. Two of the lines are 14-in. and will move crude to the refinery tank farm. New pumping facilities also have been installed. The company has three new plants for the manufacture of lubricating oil to be brought on stream at Llandarcy this summer. While new tankage for lubes is being built near the docks, most of the production will be moved through the lines to tankers for further delivery.

Shell's LS-1387 in Western Venezuela, the deepest well drilled outside the United States, has reached 17,475 ft. The test, being drilled by Venezuelan Oil Concessions, Ltd., is located 12 miles south of Lagunillas and is investigating the Cretaceous.

Elected Veep

Boatright named general manager of gas company

DR. BYRON B. BOATRIGHT recently was elected vice president and general manager of the newly formed Houston Natural Gas Production Co. The Houston firm is a wholly owned subsidiary of Houston Natural Gas Corp.

For the past 3 years he has been a consulting engineer and has worked for the governments of Canada, Mexico, and the United States, as well as for oil companies.

His early experience includes work as a roustabout for Mutual Oil Co. and as a tool dresser for Midwest Refining Co. in Wyoming. Later he joined the Bureau of Mines at Denver. He was an associate engineer for the bureau when he resigned to become a district engineer for the old Marland Oil Co. in North and West Texas.

For 8 years Boatright was head of the petroleum-engineering department at the Colorado School of Mines. He received his Ph.D. degree in geology from the University of Colorado in 1936.

He then went to Corpus Christi as a consulting engineer for what was then the firm of Parker, Foran & Knode. He became a partner at Houston and remained with the firm until 1946. This organization designed and assisted in the construction of the first cycling plant in Agua Dulce field. The plant was built for Process Oil Co.

Later he served 2 years as vice president and chief engineer for Republic Natural Gas Co., Dallas, and 2 years as executive vice president for Conroe Drilling Corp. and general superintendent for Heep Oil Corp., Austin.

Felix Edgar Wormser, vice president of St. Joseph Lead Co., New York, was nominated by President Eisenhower last week as an assistant Secretary of the Interior. Wormser, who many years ago was employed in the Bureau of Mines, is to head up the mineral activities of the department, which include the several agencies dealing with petroleum.

H. J. Gruy and **Roy T. Durst** have formed a petroleum consulting partnership at Fort Worth. Gruy has been a consulting engineer at Fort Worth since 1950. Durst formerly was general production superintendent for Rowan Oil Co. there. They will specialize in appraisals, reserve estimates, and management of drilling and production operations.

John D. Hockensmith, formerly chief geologist in charge of exploration departments for Stanford Oil Co., Evansville, Ind., and Chicago, has returned to his consulting practice in the Tri-State area. He has headquarters in Evansville.

G. H. Brodie, geological consultant, has returned to Denver following a 3-week tour of the Middle East.

G. S. Baumgartner, engineer of the lube-treating department of the refinery of Union Oil Co. of California at Oleum, Calif., has been named superintendent of the Maltha refinery near Bakersfield. Baumgartner succeeds **Homer Ambrosier,** retired, who has been superintendent the past 27 years. **B. L. Johnston** has been appointed assistant superintendent at Maltha.

Cyrus S. Killgore has been promoted to division geologist for Continental Oil Co. at the newly created geological division offices at New Orleans. Named to succeed Killgore as assistant division geologist at Midland, Tex., is **Robert F. Matthews,** who has been with Continental's exploration operations in Wichita Falls and Midland since 1948. Four geologists who were named to head newly created geological districts in the firm's Midland division were: **C. A. Barton, Nance G. Creager, A. J. Manulik,** and **F. L. Stead,** all of whom will continue to make Midland their headquarters.

J. Robert Penisten, formerly assistant refinery superintendent for Frontier Refining Co. at Cheyenne, has been appointed an engineer for Universal Oil Products Co. at Des Plaines, Ill.

Garvin Berry has resigned as area geologist for Stanolind Oil & Gas in the Billings, Mont., district. He will join his father, **R. G. Berry,** Tulsa independent producer, and will do geological work in Oklahoma, Kansas, and Texas.

S. P. Burden, formerly assistant geologist for Socony-Vacuum Exploration Co., Calgary, has been named to head the Canadian subsidiary of Oil Drilling, Ltd., Houston. The new company will operate under the title of H. Merlyn Christie and be based in Calgary.

B. E. LINDSLY

Ben E. Lindsly has retired as chief of the oil and gas section of the Securities and Exchange Commission and will open an office in Washington, D. C., as a consultant on public and private financing of oil properties. He will be succeeded at the SEC by **Tell T. White,** who has been his assistant for several years. Lindsly got his start in the oil business as a roustabout for Honolulu Consolidated Oil Co. at Taft, Calif., later advancing to field engineer and technical researcher. He later became chief engineer for Bigheart Producing & Refining Co. at Bigheart, now Barnsdall, Okla. From there he moved to Ardmore, Okla., where he had an engineering office. He joined the Bureau of Mines in 1924 and in 1934 became chairman of the new pools committee of the Petroleum Administration Board of the Department of the Interior. He became a senior petroleum engineer for the SEC 2 years later.

Kenneth Webb, geological consultant, has moved his offices from Sterling, Colo., to Denver.

C. L. Kelley has been transferred from Brownfield, Tex., to Roswell, N. M., to become district superintendent for Stanolind Oil & Gas Co. in its new district production office. The Roswell staff will be in charge of operations in New Mexico, Arizona, and

PERSONALS

11 southern Colorado counties. **E. M. Knight** has been appointed district engineer at Roswell. **W. A. Kimbrough** has been transferred from the Tulsa general offices to replace Kelley as field superintendent at Brownfield.

V. L. Frost, assistant division geologist for Ohio Oil Co. in Tulsa, has been transferred to Sidney, Neb., as district geologist, in charge of the company's geological operations in that area.

Hubert L. Popenoe has been appointed area geologist for Shell Oil Co. in Los Angeles. He formerly was district geologist for the company's coastal division in Los Angeles. He joined Shell in 1937 as an assistant geologist.

Frank C. Havens has been elected a vice president of Platte Pipe Line Co., Kansas City. He formerly was treasurer. Havens joined the company shortly after it was organized in August 1950 and prior to that served 26 years with Continental Oil Co.

Paul D. Sweitzer, field engineer for The Texas Co., has been transferred from Sundown, Tex., to Monument, N. M.

Charles V. Steed, Jr., has joined Tide Water Associated Oil Co. as an associate engineer at the company's Drumright, Okla., refinery. He previously was with Mid-Continent Petroleum Corp.

W. C. Wunnicke, farm boss for Stanolind Oil & Gas Co., has been transferred from Farmington, N. M., to Ignacio, Colo.

L. C. Decius, who recently retired as vice president in charge of exploration for Tide Water Associated Oil Co., has opened a consulting office in San Francisco.

Charles H. Dollison, Jr., has resigned as district petroleum engineer for Tide Water Associated Oil Co. at Kilgore, Tex., to join DeGolyer & MacNaughton in Dallas. **Louis J. Crippen, Jr.,** field engineer for Tide Water at Robinson, Ill., also has resigned to accept other employment.

New T.I.P.R.O.A. Officers

Here are the officers of the Texas Independent Producers and Royalty Owners Association who were elected recently at the association's annual meeting in San Antonio. Seated, left to right, are: William T. Beard, Jr., San Antonio, treasurer; and M. D. Bryant, San Angelo, president. Standing, left to right, are: E. I. Thompson, Austin, executive vice president; Bryan W. Payne, Tyler, vice chairman; and Bert Fields, Dallas, secretary.

O. Norman Duncan, assistant superintendent at the Torrance, Calif., refinery of General Petroleum Corp., has retired after nearly 34 years in refinery operations. He has been at Torrance since 1941.

H. B. Lemaire, formerly mechanical engineer in Shell Oil Co.'s Los Angeles area offices, has been appointed foreman of the southern pipe-line district at Simi, Calif.

Alfred J. Oakey, petroleum engineer for The Texas Co., has been transferred from Fellows, Calif., to Bakersfield, Calif.

J. R. Enloe, petroleum engineer for Amerada Petroleum Corp., has been transferred from Tatum, N. M., to Seminole, Tex.

Robert E. Lewis has been transferred from the geological to the production department of W. C. McBride, Inc., Tulsa, as development geologist.

J. M. Kilborn, party manager for Gulf Research & Development Co., has been transferred from San Angelo to Odessa, Tex.

L. J. Beckman, Cleveland, has been named a staff member of the executive department of Cities Service Oil Co. (Del.). **John T. McDowell** has been named to succeed Beckman as manager of the company's Cleveland marketing region.

S. B. Irelan, president of Cities Service Oil Co., has been elected a member of the board of directors of Empire Gas & Fuel Co., parent of the company he heads.

G. H. Allen, G. C. Knowles, B. Middleton, Dr. A. W. Nauss, and **R. W. Robertson** have been elected members of the board of directors of Scurry Oils, Ltd. **J. F. Langston** was reappointed president at the annual general meeting of shareholders in Calgary recently.

Earl S. Neal, general manager of the producing department of Imperial Oil, Ltd., has been elected a director. He formerly was chief geologist for Lago Petroleum Corp. in Venezuela and was in charge of the world-wide petroleum-reserve studies and head of the producing-economics section of Standard Oil Co. (N. J.).

Ralph E. Kuster has been appointed corrosion engineer for Union Gas Co. of Canada, Ltd. Kuster will be in charge of the company's cathodic protection program and work under the engineering department at Chatham, Ont. **Gordon Russell,** formerly in corrosion work for the company and later in the transmission and distribution department, has resigned to join Trans Mountain Pipe Line Co. at Vancouver.

PERSONALS

Harry Rector has retired as drilling superintendent of the southern district for Standard Oil Co. of California. He had been with the company since 1916.

Ernest Robinson, Denver petroleum consultant, has been elected a director of Great Plains Development Co. of Canada, Ltd. Robinson joined Shell interests in 1925 and served with that firm until 1952.

J. C. McCarthy, district engineer for Stanolind Oil & Gas Co. at Midland, Tex., has been promoted to division engineer at Casper, Wyo.

C. E. Armstrong, district superintendent for Sohio Petroleum Co., has been transferred from Independence to Eureka, Kans.

Eugene N. Bennett, petroleum engineer for Stanolind Oil & Gas Co. at Ellinwood, Kans., has been promoted to field engineer at Ulysses, Kans.

Leonard McCasland has joined Atlantic Refining Co. and is in training as a petroleum engineer at Denver City, Tex.

Jorge Otero, formerly superintendent of the Cochabamba refinery operated by Yacimientos Petroliferos Fiscales Bolivianos (Y.P.F.B.), has enrolled for a special course at Tulsa University.

Jacques R. Lo-Fo-Sang and **Floriano Geerman,** of the Aruba, N.W.I., refinery of Lago Oil & Transport Co., Ltd., have been promoted to subforemen at the refinery. Both are connected with the refinery's maintenance division.

Bob Wakefield, Dick Wing, and **Emerson Beekly** have joined the geological staff of The Texas Co. at Bismarck, N. D. Beekly and Wakefield formerly were in Lewistown, Mont., and Wing recently was released from the Army.

Clarence Kent has been appointed a petroleum engineer for the mineral resources branch of the Department of Natural Resources in Regina, Sask. He is a University of Alberta graduate in petroleum engineering.

L. I. Brown has been appointed manager of the exploration department of The California Co., New Orleans. Under the new company setup, exploration activities will be conducted by two departments — exploration and land. **T. C. Nugent,** vice president, will be in charge of the land department, which will operate as a service organization for the exploration department.

Donuil Hillis has resigned from Fullerton Oil Co. at Midland, Tex., to become a consulting geologist at Denver.

Douglas Sheffer, geologist, has joined the staff of Sun Oil Co. in Bismarck, N. D. He formerly was located in Casper, Wyo.

J. E. Martin, assistant manager of the Chicago division for Mid-Continent Petroleum Corp., has been named to succeed **Ross N. Carter,** who is retiring as manager. Martin was named assistant manager of the Chicago division in July 1949.

E. M. Robinson, executive of Creole Petroleum Corp. and member of the company's management committee, recently resigned and has returned to the United States from Venezuela, where he had served with the firm for a number of years.

DEATHS

Otis W. Dyer, 65, Houston drilling contractor, was killed in an automobile accident April 3 near Kingman, Ariz. He formerly was active in the drilling of Rodessa field in Caddo Parish, Louisiana, and moved to Houston in 1936.

Charles Drader, 78, retired official for Kern Oil Co., Ltd., died April 2 in Beverly Hills, Calif. He was born in Petrolia, Ont., and joined the company, then known as Kern River Oilfields of California, Ltd., in 1912. He served as general superintendent, general manager, and as a member of the management committee. Since his retirement in 1942, he had been a consultant to the local management committee.

Merrill H. Robinson, 55, former Sun Oil Co. district manager at Newark, N. J., died March 31 at his home in Short Hills, N. J. He had been on leave of absence because of illness.

R. P. Brooks, 70, retired independent oil operator, died March 31 at his home in Dallas. He moved to Dallas 5 years ago from Longview.

Henry W. Kortlander, 71, who organized Merchants Petroleum Co. in 1927 and served as its president until 1949, died recently in Los Angeles.

Paschal Gilmore, 45, owner of Gilmore Pipeline Construction Co., died April 2 in Hays, Kans.

Charles Layman Ridenour, 78, Tulsa, retired oil-field contractor, died April 5 near Tulsa.

William Clayton Webb, Sr., 68, retired head of the distributing department of Gulf Oil Co.'s sales division, died recently in Houston.

Horace B. Clay, 69, general counsel for Wilcox Oil Co. since 1922, died April 5 in a Tulsa hospital.

Moise S. Adjemoff, consultant on the international oil business who was an adviser to Calouste S. Gulbenkian, the 5 per cent interest-holder in Iraq Petroleum Co., Ltd., died March 31 in New York. Adjemoff lived in Paris but made frequent trips to the United States and had been in this country since November.

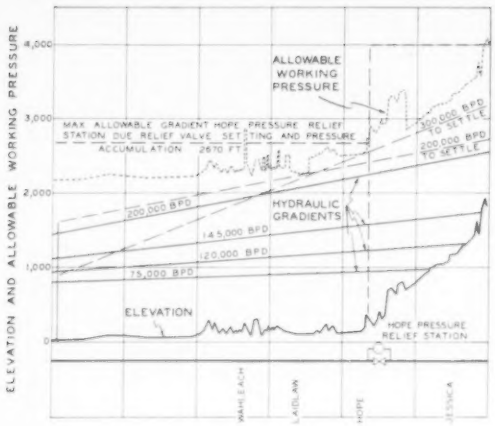
Frank W. Bruner, southern division superintendent for Carter Oil Co. at Shreveport since 1945, died in Shreveport April 6. He joined Carter at Burbank, Okla., in 1922, and had worked at Oklahoma City, Seminole, Okla., Mattoon and St. Elmo, Ill., and Billings, Mont.

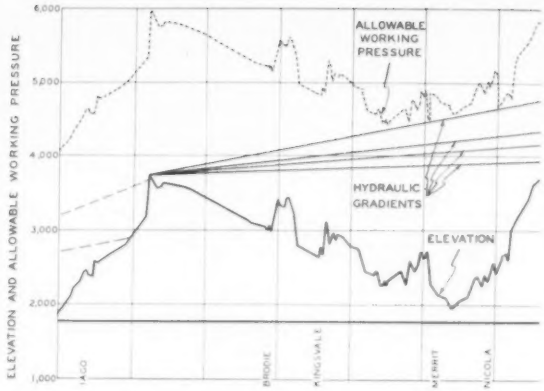
William G. Morrisey, Jr., 61, executive vice president of Metropolitan Petroleum Corp., died April 3 in New York.

Charles Mason Robert, 46, field drilling and production superintendent for Union Producing Co. in the New Orleans district, died April 3. He was a long-time employe of the firm, which is a subsidiary of United Gas Corp.

J. Gordon Turnbull, 62, nationally known construction engineer, died in Los Angeles recently. He took part in the government's Canol project in Alaska during World War II.

Roy C. Busby, 66, vice president of Whitehill Oil Corp., died April 6 at his home in Tulsa. He had been with Whitehill the past 25 years and was also a director. Prior to that he worked for Pan-American Refining Co.





Three sections of profile and hydraulic gradients in western part of the indicated. Town names at the bottom of the map orient the line.

Mountainous Terrain Poses Tough

Two different types of pressure-limiting stations will be a feature of this new Canadian line. These saved an estimated $5,000,000 in the line's original investment

by Paul Reed
Pipe-Line Editor

BECAUSE of the unusual mountain terrain at the western end of the Edmonton-Vancouver crude-oil line of Trans Mountain Oil Pipe Line Co., it was necessary to make special provisions in the design which depart from customary practice.

Probably the most notable of these are the pressure-limiting stations of two different types which will prevent excessive static pressures. Two of the three pump stations will be operated in parallel while the third station at an intermediate point will be operated in series.

The Trans Mountain project has been discussed in four articles in The Oil and Gas Journal: (1) July 28, 1952, page 190, dealing with the general conditions of the undertaking; (2) August 4, 1952, page 50, economic conditions; (3) October 13, 1952, page 272, pipe-laying methods; (4) October 13, 1952, page 342, terrain of the route.

Terrain . . . The nature of the route of the Trans Mountain 711-mile, 24-in., line may be roughly summarized by giving the characteristics of four sections as follows: (1) 50 miles of wheatland west of Edmonton; (2) 200 miles of rolling-timber country to Jasper; (3) 391 miles of mountain, valleys, plateaus, and canyons west of Jasper; and (4) 70 miles of farmland in lower Fraser Valley to Vancouver.

At two points on the line hydraulic problems require special attention. Between Jasper, Alta., and Vavenby, B. C., there is a difference in elevation of 2,300 ft. in 200 miles and at Hope, B. C., there is a difference in elevation of 3,700 ft. in 30 miles.

Line operating conditions . . . In the course of laying out the route of the line, each survey party was accompanied by a man with practical pipe-line-construction and maintenance experience who had the responsibility of seeing that required pipe bends would be suitable for the running of scrapers and that construction costs would be kept to a minimum.

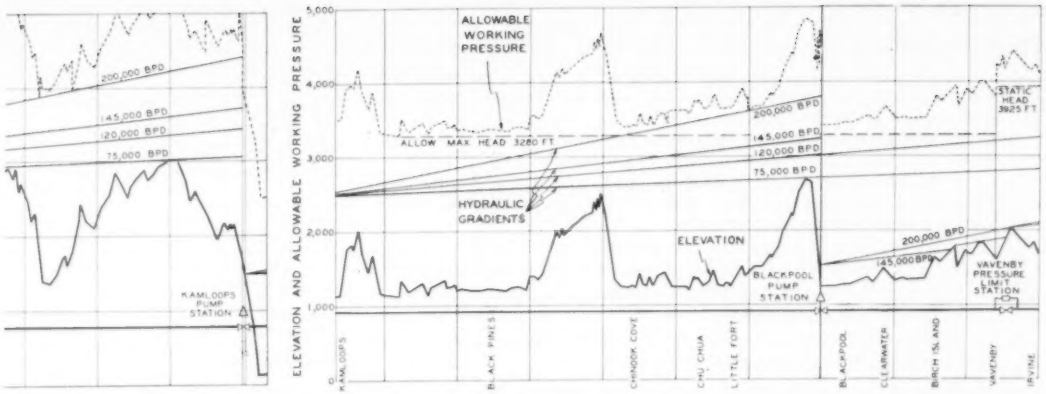
The pipe was buried throughout the route for safeguarding against damage by both landslides and snowslides and for insulating against the congealing effects of low temperatures which would result in the deposit of wax in the line. There is no span along the line except at one spot where an extremely deep canyon made a buried crossing impracticable.

Winter temperatures . . . At times the ambient temperature in certain sections drops as low as —50° F. However, it is expected that temperature of the oil stream will not be lowered as much as that of Interprovincial's crude-oil pipe line from Edmonton eastward toward Lake Superior. Much of the ground over the Interprovincial line lacks the insulating effect of snow because it is swept bare by the wind. Most of the Trans Mountain line is through wooded country where it will be covered with snow, in some places as much as 5 or 6 ft. Average design temperature for oil in the line was +40° F.

Wax removal . . . To facilitate the removal of wax extracted from the line by scrapers, the scraper trap barrels will be 50 ft. long. Scraper traps will be installed at approximately 100-mile intervals. Locations will be at all prospective station sites as well as at intermediate points between stations; 80 main-line block valves will be installed in the line at locations where necessary to suit hydraulic conditions.

Crude segregation . . . Crude oil will be moved through the Trans Mountain line in four segregated grades: (1) Redwater crude; (2) Leduc; (3) Big Valley-Stettler; and (4) Wizard Lake-Joseph Lake.

Wall thickness . . . Schedules for overland construction call for pipe in the following amounts and wall thicknesses: 117 miles of ¼-in.; 23 miles of 9/32-in.; 470 miles of 5/16-in. 54 miles of 11/32-in.; 36 miles of ⅜-in.; and 4 miles of 7/16-in. For rivers and other



Trans Mountain Oil Pipe Line Co. system now under construction. Locations of pump stations, relief station, and pressure-limiting station are

Hydraulic Problems for Trans Mountain

water crossings there will be 7 miles of ½-in. pipe.

Completed sections of the line will be hydrostatically tested, beginning in May on sections completed in 1952. Hydrostatic tests will continue until the pipe laying is completed in August in order to prepare for initial deliveries at Vancouver in October.

Pressure-limiting stations . . . The two pressure-limiting stations are of two kinds: one restricts the downstream static head by tight shutoff during no-flow conditions; the other dumps oil through a battery of relief valves into tanks to insure maintenance of safe pressure conditions.

The first pressure-limiting station is located at Vavenby. From Vavenby upstream to the high point in the line 20 miles east of Jasper, a distance of about 200 miles, there is a difference in elevation of 2,300 ft. An automatic shutoff at Vavenby insures that static head downstream of Vavenby shall be reduced by 650 ft. to a safe head of 2,160 ft.

The other pressure-limiting station located at Hope, B. C., drains oil through a battery of relief valves to two 50,000-bbl. tanks so that static head may be reduced to limits of safety. At this point there is a static head of 3,700 ft. between elevations of 100 to 3,800 ft. within a distance of 30 miles of pipe.

It was estimated that the use of these pressure-limiting devices saved approximately $5,000,000 in the original investment of the line by avoiding additional expenses of heavy-wall pipe which would otherwise be required for withstanding high pressures during shutdown conditions in the low sections of the system.

Pump stations . . . For the initial throughput of 120,000 bbl. daily, the line will have three pump stations, with 13,200 installed horsepower, costing some $4,000,000.

All three stations will be equipped with four-cycle diesel engines driving centrifugal pumps through gear units. Stations 1 and 3 which have a parallel pumping arrangement, are equipped with eight-cylinder engines, while Station 2, which has a series pumping arrangement, is equipped with six-cylinder engines. Engines and pumps will be separated by a fire wall at each station.

The locations and types of engines of these three stations will be as follows: Station No. 1—Edmonton, Alta., (next to the pump station of Interprovincial Pipe Line Co.) three 1,760-hp. supercharged engine-driven pumping units operated in parallel. Station No. 2—Marlboro, Alta., (10 miles west of Edson) 141 miles west of Edmonton, three 1,320-hp. supercharged engine-driven pumping units operated in series. Station No. 3—Kamloops, B. C., 3½ miles west of Kamloops on Trans-Canada Highway, three 1,320-hp. engines without superchargers driving three units to be operated in parallel.

Much study was given to the comparative merits of parallel and series pumping. It was finally determined that parallel pumping was more economical for the static head conditions at Edmonton and Kamloops and that series pumping was more suitable for Marlboro.

Due to the high static head to be overcome at Station 1 at Edmonton and Station 3 at Kamloops and the future station at Black Pool, these stations are designed for operation of pumping units in parallel. Station 2 at Marlboro and the future stations at Gainford and Jasper will be connected in series. At Edmonton for the initial throughput of 120,000 bbl. per day the static lift will be about 45 per cent of the total pumping head. Likewise at Kamloops at the initial throughput of 120,000 bbl. per day the static lift will be about 65 per cent of the total pumping head.

For these stations operating against high static heads there are distinct advantages to parallel pumping. With parallel pumps it is possible to maintain any flowing rate within the capacity of the pump installed with a minimum of throttling and wasted horsepower through varying the number of units operated. Series pumps in these installations would have the weakness that all units would have to be operated either throttled or at reduced speed consistent with head-capacity requirements at points of greatly reduced efficiency.

Since the line capacity demand cannot be predicted precisely and since station equipment will probably be installed in rather large incremental steps, parallel pumps at the three stations named seem to offer the most economical and flexible arrangement.

(Continued on page 119)

The author concludes . . .

The lime-treated mud proposed (Table 1) has these advantages over low-pH red muds and conventional lime-base muds, in drilling where abnormally high temperatures are encountered:

1. It is considerably more resistant to contaminants than low-pH red mud.

2. It can be used for considerably longer periods at temperatures over 250° F. before serious buildup of calcium silicate. This is because caustic soda and lime contents are very small.

3. Excellent S.P. logs are obtained. Resistivity of this mud is 2 ohm-meters as compared to 0.2 ohm-meters for conventional lime-base muds.

4. Less hazard in handling. Filtrate alkalinity is very low.

5. Chemical-treatment costs are lower.

6. Workover operations are simplified when lime-treated mud is used above packers in original completion operations.

TABLE 1—COMPOSITION OF LIME-TREATED MUD* FOR DRILLING HIGH-TEMPERATURE FORMATIONS

5 lb. per bbl. high-grade bentonite†
1 lb. per bbl. caustic soda
2 lb. per bbl. quebracho
2 lb. per bbl. lignitic emulsion stabilizer
1 lb. per bbl. CMC, polyacrylonitrile, or similarly stable organic water-loss reducing material
Barite to yield the desired weight
10 volume-per cent diesel oil
Lime—add when necessary to maintain a pH of 10.5 to 12.0

*** The order of addition should be from top to bottom as listed.**

† Higher concentrations may be necessary in lower-density muds.

A Drilling Fluid for Use in *Drilling High-Temperature Formations*

by T. E. Watkins*

IN the past few years a great effort has been expended for the discovery of oil reservoirs at much deeper horizons than those being commercially exploited at the present. This deeper drilling has produced a multitude of new drilling, logging, and production problems.

Conventional lime-base drilling fluid with its stability toward contaminants and its ease of maintenance[1,2] has been used very successfully in drilling operations where extremely high temperatures are not encountered. However, this type of mud system has been found to be inadequate for the role required of a drilling fluid to be used in deep-drilling operations where formation temperatures of the order of 300° F. are encountered.

It has been found in deep-drilling operations that the conventional lime-base drilling fluid often becomes semi-solid or solid near the bottom of the hole when circulation of the fluid is discontinued for a period of several hours. Under these conditions, logging tools or perforating guns cannot be successfully run to the bottom of the hole and often it becomes necessary to "wash" or "ream" to bottom. In addition, it has been found that workover operations are difficult and expensive when a lime-base mud has been placed above the production packer.

The low electrical resistivity of conventional lime-base drilling fluids has proved to be a definite handicap to their use, because very poor self-potential (S.P.) logs are often obtained with a low-resistivity mud.[3] A good self-potential curve is considered a necessity in exploratory operations and in thin-sand completions.

Thus, a need has become increasingly evident for the development of a mud system which will function satisfactorily at the high temperatures where conventional lime-base muds have proved to be unsatisfactory.

Laboratory Investigation

During the course of investigating muds for use in drilling high-temperature formations, attention has been directed primarily toward three basic types of fluids. The following definitions are advanced for these three basic types of muds:

1 Low-pH red mud—A mud whose pH is not greater than about 12.0, and which contains natural tannins, lignitic materials, or a combination of these or equivalent materials, as dispersing agents.

2 Lime-base mud—A mud similar to the foregoing, but containing caustic soda and lime. The pH of such a mud will be in excess of 12.5, and the content of solid (undissolved) lime in the circulating system will be on the order of 1 to 50 lb. of lime per barrel of mud.

3 Lime-treated mud—A low-pH red mud which has been treated with relatively small amounts of lime such that little or no insoluble lime is present in the mud system.

The laboratory portion of this program has included preparing and testing a wide range of compositions of these three basic types of muds. Primary considerations have been the effectiveness of (1) viscosity control of heavy weighted muds; (2) suppression of swelling and dispersion (contribution to increased viscosity) of bentonitic clays; (3) suppression of tendencies of the muds to set at high temperatures; (4) retention of good filtration properties at high temperatures. The joint effects on these several mud properties by variations in electrolytic content, alkalinity, nature and concentration of the dispersants, and treatment to reduce fluid loss have been examined.

It should be pointed out that the results of the high-temperature filtration tests are relative, and should serve as a guide to indicate the most desirable treating procedure for obtention of a minimum bottom-hole filtration rate.

A comparison of the corrected 30-minute water-loss values at 80° F. and 325° F. (Table 2) shows that a definite

*Magnolia Petroleum Co., Research Laboratory, Dallas. Summary of paper presented at A.P.I. spring meeting, Southwestern District, Division of Production, Fort Worth, March 4-6, 1953.

TABLE 2—WATER LOSS OF LOW-pH RED MUDS, LIME TREATED RED MUDS, AND LIME-BASE MUDS AT 80° F. AND 325° F.

Mud Type	Mud Sourse	Corrected 30-Min. Fluid Loss cc. 80° F.	325° F.	Factor of Increase
Low-pH red	Field	8.7	15.0	1.7
low-pH red	Field	5.0	8.1	1.6
Low-pH red	Lab.	5.2	11.2	2.1
Lime-base	Field	0.7	5.8	8.2
Lime-base	Field	3.7	36.4	9.8
Lime-base	Lab.	5.6	32.6	5.8
Lime-base	Lab.	2.5	25.2	10.0
Lime-treated	Field	6.6	13.6	2.1
Lime-treated	Field	4.0	9.8	2.5
Lime-treated	Lab.	3.0	7.2	2.4

range of water-loss values is characteristic of each mud type with regard to the magnitude of increase in water loss in going from the lower to the higher temperature.

Low-pH red muds . . . The low-pH red muds increased in water loss by a factor of approximately 1.8 in going from the lower to the higher temperature. The reduction in viscosity of the liquid phase should account for this increase. It has been shown that the effect of pressure differential on filtration rate in the range of 100 to 500 psi. is very small.[4]

Lime-base muds . . . In the case of the lime-base muds, the 325° F. fluid losses were found to be from 5.8 to 10.0 times as much as those obtained at 80° F. Starch, which is decomposed at the high temperature used in the testing procedure, was the water-loss-reducing additive for conventional lime-base drilling fluids. In addition, the high content of caustic soda and lime will, over a period of time at high temperatures, convert the montmorillonite-type clays and certain other mineral constituents to materials which are less effective in reducing the water loss of a mud.

Lime-treated muds . . . The ratio of water-loss values obtained at high-temperature (325° F.) to those obtained at 80° F. with the group of lime-treated muds was found to be approximately 2.3. The water-loss reducing agent for this group of muds was CMC (sodium carboxymethylcellulose), as in the low-pH red muds. Polyacrylonitrile or another heat-stable water-loss reducing agent could also be used. The slightly greater increase in water loss at high temperature for this type of mud as compared with the low-pH red mud is, posibly, a result of the lime treatment.

Performance Summary

Low pH-low mud . . . This mud retains a low fluid loss at high temperatures; and it does not undergo the excessive high-temperature cementation exhibited by lime-base muds. It is unsatisfactory for drilling a bentonitic or "mud-making" shale when high mud densities must be maintained, because excessive quantities of mud must often be discarded. The mud has a relatively high resistivity (on the order of 2 ohm-meters); and, therefore, will permit good S.P. logs. It is not sufficiently alkaline to be hazardous to handle. The principal objection to this mud type is its instability toward contaminants.

Lime-base mud . . . This mud provides excellent control in drilling mud-making shales. It is very stable and easy to control at temperatures not in excess of 250° F. However, it is entirely unsuited for drilling at temperatures appreciably above 250° F. because of the development of a complex calcium silicate which causes a cementation of the mud when allowed to stand at such temperatures. Further, the filter loss of lime-base muds becomes very high at such temperatures. Frequently very poor S.P. logs are obtained because of the low resistivity of the mud; and it is hazardous to handle because of its high alkalinity.

Lime-treated mud . . . This mud has been found to be reasonably satisfactory for drilling bentonitic shales because the extreme mud-making tendency of the shale is restrained by conversion of sodium clay to calcium clay. The mud exhibits good filtration properties and appears to exhibit little tendency to gel strongly at high temperature. This mud system requires close supervision, but chemical treatment is somewhat less expensive than with conventional lime-base muds. It provides excellent S.P. logs and is relatively safe to handle.

Factors Affecting Composition for Deep Drilling

The following factors, which are based on experience accumulated during the study of high-temperature effects in lime-base drilling fluids, are believed to be of primary concern in the formulation of a drilling fluid for use in drilling high-temperature formations.

1. The mud-making action of shales must be restrained. In order to do this the dispersible shales should be converted by a base-exchange process to a form that swells or disperses to a lesser degree, or is restrained from swelling and dispersing by some means such as by a high concentration of electrolyte.

2. In highly weighted muds, which may also accumulate shale solids, effective dispersion of mud solids is essential to viscosity control. In such muds, particularly at low alkalinity, dispersing agents have not proved to be adequately effective in muds containing high concentrations of sodium chloride, soluble calcium salts, or other electrolytes.

3. The reaction of lime with quartz and clay at high temperature to produce a cementatious material[5] should be suppressed or eliminated. This can be accomplished by not allowing free lime to be present in the circulating mud system. By maintaining a pH value below 12.5 the absence of excess (undissolved) lime will be assured, inasmuch as the pH of a saturated lime solution is approximately that value. Furthermore, in the interest of safety, it is desirable to avoid the extremely high alkalinity found in conventional lime-base drilling fluids.

4. In order to provide adequate S.P. logs, it is desirable that the mud have an electrical resistivity on the order of 2 ohm-meters. To maintain mud resistivity at this level necessitates that the electrolyte content be maintained at the lowest practicable concentration.

5. In order to provide satisfactory filtration characteristics at very high temperatures, organic water-loss-reducing additives which are moderately stable at high temperatures must be employed. Starch does not appear to be satisfactory for such use, whereas CMC and sodium polyacrylonitrile are comparatively satisfactory.

In summary, a base-exchange process may be utilized to inhibit excessive mud making by bentonitic shales; however, the mud should preferably not contain free lime or appreciable concentrations of electrolyte. Alkalinity should be kept as low as practicable in order to maintain high resistivity and minimize hazards from bodily contact. A maximum pH value of 12.0 should usually satisfy these latter requirements. Tannins or lignins should be utilized as dispersing agents; lignins as emulsifying agents; and CMC, polyacrylonitrile, or other comparatively heat-stable organic colloid should be used to control fluid loss. Caustic soda should be utilized only in the minimum amounts necessary to solubilize added tannins and lignins.

Program for Drilling High-Temperature Formations

Field tests have been carried out utilizing what appeared to be optimum formulations of each of the three types of mud systems previously discussed. Data and information obtained during these several field tests and in laboratory tests have been considered in planning the mud program presented following for drilling in high-temperature formations, especially for exploratory drilling where logging data are of vital importance.

Drill with the conventional mud pro-

(Continued on page 120)

BUILDING REFINERY PROCESS UNITS—4

. . . Job-Progress Reporting

Scheduling of refinery units cannot be complete unless a close check is kept on the progress of the job. In this, the final article of a series, the four basic progress reports are dealt with. These are: (1) drawing control, (2) material status summary, (3) construction progress report, and (4) over-all job schedule progress report.

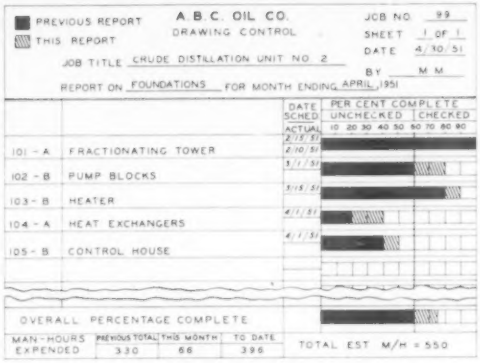


Fig. 1—Drawing-control report.

by M. Mattozzi*

THE three preceding articles have dealt purely with methods of developing a master project schedule which would outline the timing and sequence of specific major operations permitting conduct of work in an expedient, orderly fashion aimed toward a realistic target. However, to be completely effective planning must necessarily keep pace with activity so that it will not only reflect objectives but also how and when they are met. If this comparison is not shown clearly, the schedule cannot fulfill its true purpose as a live working document and diminishes in value.

Checking job progress . . . To permit the recording of progress against each "control item" the Scheduling Unit must rely on certain basic reports prepared periodically by others, detailing the status of work in various phases. These reports must be fairly accurate since the function can operate only as effectively as the information supplied and the degree of cooperation and authority bestowed upon it by management when correcting lack of progress. Furthermore it is good practice to discuss job progress periodically with those individuals particularly concerned. Ultimately such discussions and reports will serve to point up conditions that require emphasis or attention.

The Four Basic Reports

Progress reports should be supplied to the Scheduling Unit, prepared at intervals according to the degree of control desired but not losing sight of the fact that such reports mean effort and paper. These basic reports are: (1) Drawing Control, (2) Material Status Summary, (3) Construction Progress Report, and (4) Job Schedule Progress Report.

Drawing control (Fig. 1) . . . This is a report issued by the Drafting Group outlining progress on drawings in each category. All like drawings should be grouped together but it is usually wiser to prepare one sheet for foundation drawings, one for structural steel, etc. Note under "Date, Sched. — Actual" that the upper date represents expected completion for the particular drawing obtained from the master schedule while the lower date records when the drawing was actually finished. In addition under "Per Cent Complete" we have indicated that foundation drawings are essentially 60 per cent done when ready for checking. As this differs with various types of drawings, this information should be obtained by reference to Table 1, Part 2.

The bars representing progress are self-explanatory but note at the bottom of the form that the "Over-all Percentage Complete" was obtained by calculating amount of work accomplished on each drawing based on an average requirement of 110 hours each, (6 sq. ft. by 18.4 sq. ft. per foundation drawing, as per Table 1, Part 2). Included also are the "Total Estimated Man-Hours" and a summary of actual hours expended, but these data are necessary only if some control of drafting manhours is deemed desirable or if a measure of productivity is desired.

From this report, certain drafting actions are recorded on the master schedule. Specifically, these are the completion of layouts, and unchecked and checked drawings which permit other engineering actions such as construction releases, fabrication releases, drawing approvals, etc., data on which are usually obtained via requisition or other sources.

Material status summary (Fig. 2) . . . Although the master schedule is built from a listing of major components only, nevertheless some control must be exercised over all other items in order to prevent the "minor materials" from becoming major problems. This can be accomplished through the "Material Status Summary" usually prepared by the expediting or purchasing department. The summary should list every requisition issued on the job, regardless of whether or not material is to be purchased.

Note column "Reqn. No.— P. O. No.—" the upper portion reflects the requisition number and the lower portion the purchase order number, should these differ. Issue dates of each are also recorded to reflect any time lag in procurement. In cases where a requisition has been written but no order placed, note how this stands out as in the case of "Doors and Hardware, Wire Mesh, Tie Wire." The column "$ Value" represents the purchased value of material and is required to calculate total placements or shipments. The "Date Required" column reflects the date that was applied to the requisition which was in turn obtained from the master schedule. Since only the major components are listed on the schedule the "Date Required" for minor materials is obtained by relationship to the major items.

The "Shipping Schedule" column reflects the suppliers original shipping promise and his latest shipping schedule whether or not it agrees with the initial one. The column "Shipments" contains 10 spaces, each valued 10 per

*Arabian American Oil Co.

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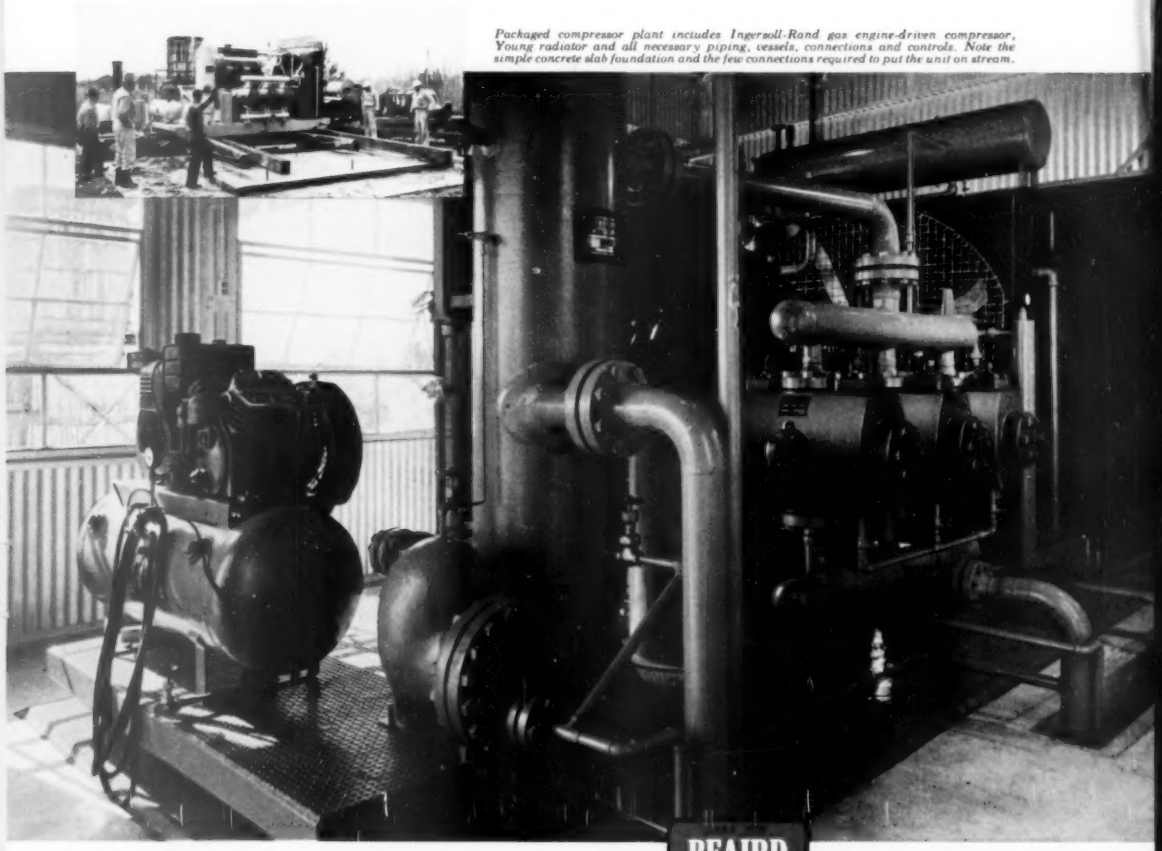
Let us show you how Beaird-Ingersoll-Rand packaged compressor plants can help you maintain maximum gas production.

Full gas production maintained —

HOW ONE PRODUCER IS EXTENDING PRODUCTIVE LIFE OF THREE OLD WELLS



Packaged compressor plant includes Ingersoll-Rand gas engine-driven compressor, Young radiator and all necessary piping, vessels, connections and controls. Note the simple concrete slab foundation and the few connections required to put the unit on stream.

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Machining
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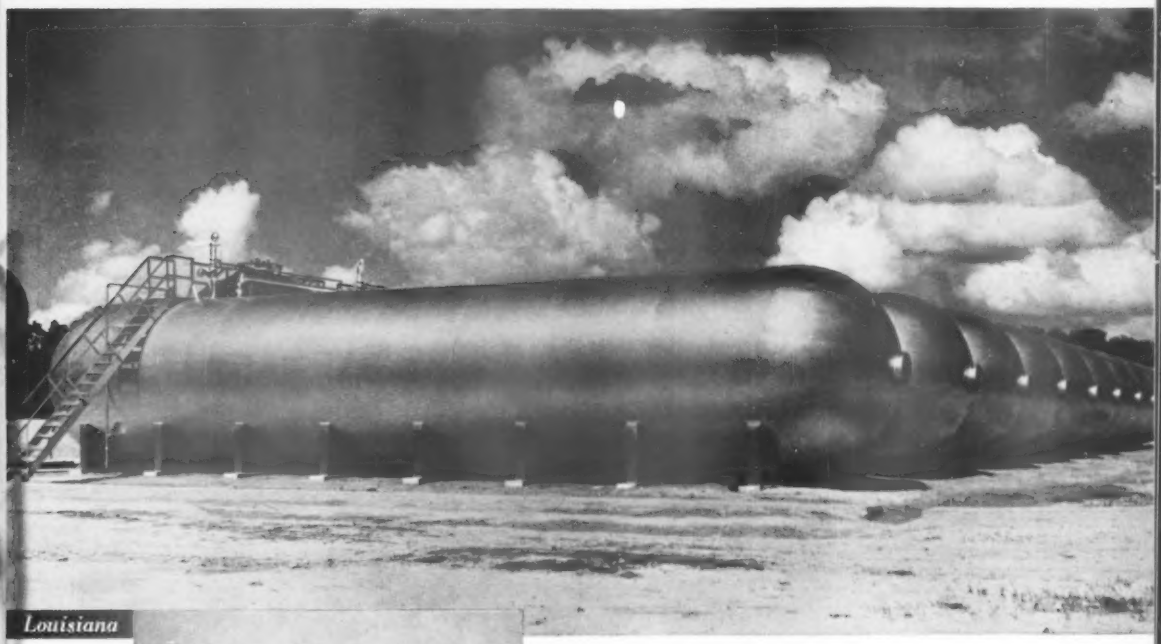
Engineered For Safe Storage

BEAIRD PRESSURE STORAGE TANKS

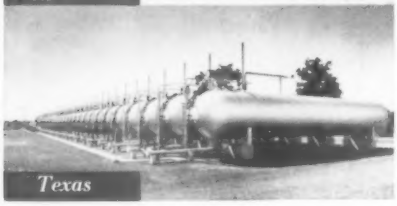


Louisiana

Nebraska

So. Carolina

New Mexico



Texas

All over the Nation

Here are a few of the installations of Beaird pressure storage tanks you'll find throughout the country—and there are many more. For Beaird has been manufacturing pressure storage equipment thirty five years. And during the past five years, Beaird production lines have been averaging one major size tank per day.

This demand for Beaird pressure storage tanks is no accident—it's the result of Beaird's advanced engineering design, constantly improved manufacturing techniques and thorough inspection and testing. That's why the firms which constructed these plants chose Beaird—that's why you too can have complete confidence in pressure tanks manufactured by Beaird.

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LP-Gas Systems

A.B.C. OIL CO.
MATERIAL STATUS SUMMARY
JOB TITLE CRUDE DISTILLATION UNIT NO. 2
REPORT ON FOUNDATION & BUILDING MATERIALS

JOB NO. 99
SHEET 1 OF 1
DATE 5/15/51
BY M.M.

REQN NO P.O. NO.	DATE	MATERIAL	SUPPLIER	DOLLAR VALUE	DATE REQ'D	SHIPPING DATE ORIG.	SCHED DATE LATEST	SHIPMENT	REMARKS
105 634	1/7/52 1/30/52	REINFORCING RODS	A.B.C. CO.	7,000	6/1/52	5/1/52	SC	4/15 4/30	
106 635	1/8/52 1/30/52	ANCHOR BOLTS	D.E.F. CO.	2,000	6/1/52 7/15/52	3/1/52 5/15/52	6/15/52		
107 636	1/18/52 2/18/52	SASH & DOOR FRAMES	G.H.I. CO.	5,600	7/15/52	6/15/52	8/15/52		
108	1/18/52	DOORS & HARDWARE			7/15/52				
109	1/18/52	WIRE MESH			6/1/52				
110	1/23/52	TIE WIRE			6/1/52				

Fig. 2—Material-status summary report.

A.B.C. OIL CO.
CONSTRUCTION PROGRESS REPORT
JOB TITLE CRUDE DISTILLATION UNIT NO. 2
REPORT FOR MONTH ENDING APRIL, 1952

JOB NO. 99
SHEET 1 OF 1
DATE 4/30/52
BY M.M.

CODE OR ACCT. NO.	ITEM	BUDGETED EST. M/H	% PER CENT OF TOTAL M/H	M/H EXPENDED TO DATE	PHYSICAL % PER CENT COMPLETE	PER CENT TOTAL EST. M/H EXPENDED	REMARKS
1001	EXCAVATION & SITE PREPARATION	3,700	1.38	3,520	100	1.31	
1002	FOUNDATIONS & CONCRETE	43,000	15.97	41,650	100	15.48	
1003	FIREPROOFING	28,000	10.40	29,500	100	10.98	
1004	ATMOSPHERIC COLUMN	20,500	7.62	22,760	100	8.45	
1005	ATMOS. COLUMN INTERNALS	10,000	3.71	13,000	100	4.83	
1006	STRIPPER TOWERS	200	.08	150	100	.06	
1007	STRIPPER INTERNALS	350	.13	400	100	.15	
1008	DRUMS	500	.19	650	100	.24	
1009	HEAT EXCHANGERS	1,000	.37	1,250	100	.46	
1010	PUMPS & DRIVERS	2,100	.78	1,000	100	.37	
1011	STRUCTURAL STEEL	10,750	4.00	9,560	100	3.55	
1012	PIPE SUPPORTS	3,000	1.11	3,580	100	1.30	
1013	CONTROL HOUSE	6,500	2.41	7,000	100	2.60	
1014	PROCESS & UTILITY PIPING	67,000	24.88	63,000	100	23.40	
1015	ELECTRIC POWER & LIGHT	25,600	9.51	24,000	75	8.92	
1016	INSTRUMENTATION	11,000	4.09	10,000	60	3.71	
1017	INSULATION	17,500	6.50	13,000	70	4.83	
1018	PAINTING	12,500	4.64	5,000	63	1.86	
1019	TESTING	6,000	2.23	1,000	40	.37	
	TOTAL	269,200	100.00	249,940	91.0	92.85	

Fig. 3—Construction-progress report.

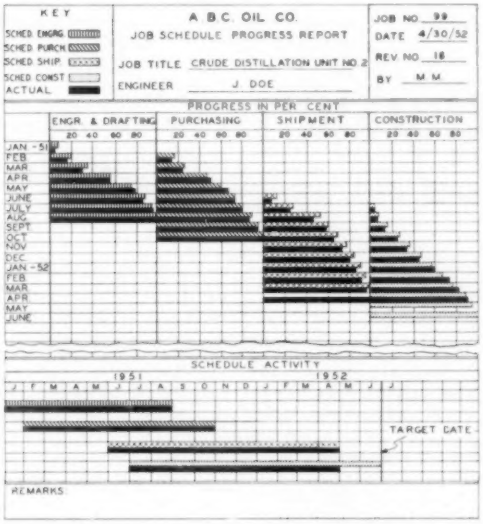


Fig. 4—Job-schedule progress report. This report may be submitted to management to indicate over-all job progress when it is not practical or desirable to transmit the three basic reports shown in Fig. 1-3 inclusive.

cent so that in the case of partial shipments, the extent can be indicated by entering the shipping date in the appropriate square corresponding to the percentage of order shipped.

In the event material requisitions are not passed through the Scheduling Unit for application of the Date Required and for the recording of their issuance, the latter information can be obtained from the material status summary, assuming of course that the Date Required is being applied to each requisition in some other manner. In addition when a requisition has turned into a purchase, the purchase order number should replace the requisition number for the major items listed on the master schedule. Control of all other materials is then achieved by a thorough review of the Material Status Summary and a comparison with the scheduled requirements.

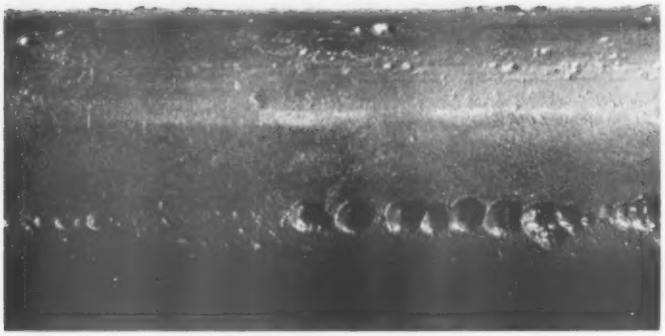
Construction progress report (Fig. 3) . . . This is a report that is prepared in the field. While it would be perhaps more advantageous from a home-office standpoint to include more detail, this may present a problem in a relatively small field office. Accordingly, a certain amount of simplicity and brevity is desirable without sacrificing the essentials. Most organizations usually supplement reports typified by Fig. 3 with some sort of narrative account of job progress. It is suggested that detailed construction progress data be included in such narratives to the extent that the master schedule may be kept up to date.

Our example of the Construction Progress Report lists a limited number of field operations including an estimate of man-hours required and the percentage of the total job represented by each. On the other hand, provision is made for the reporting of actual man-hours expended, the estimated physical precentage complete, and a calculation of the percentage of man-hours expended. With these factors and their totals, not only can actual job progress be reported, but also whether or not actual expenditures of manpower are exceeding or have exceeded the estimate, both on a direct basis and on a percentage basis.

Since much of the data necessary can be reflected on the master schedule, how deep to go in the construction progress becomes a matter of judgment and policy. As previously mentioned, more detailed data should be obtained from frequent narrative reports, unless policy within the organization permits enlargement of the Construction Progress Report.

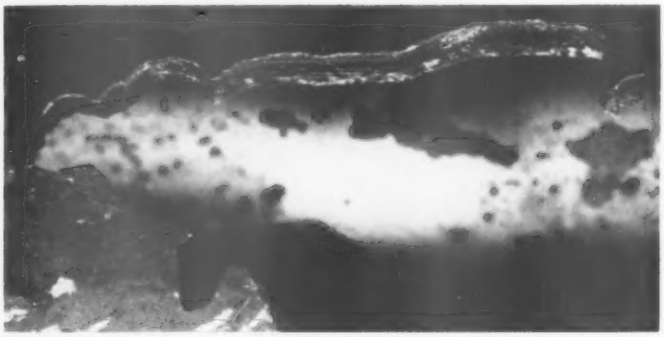
Job Schedule Progress Report (Fig. 4) All the schedules and reports dis-

(Continued on page 123)



EXTERNAL . . . Tubing taken from a bottom joint at 8,888 ft. shows general corrosion along with pitting.

Here's What's Happening in . . .



INTERNAL . . . Tubing recovered from depth of 6,750 ft. shows very severe corrosion, formation of iron sulfide.

COMBATING CORROSION

in oil and gas wells

Reported by
Gerald L. Farrar
Engineering Editor

This report to Journal readers is compiled from technical papers, committee reports, informal discussions, and symposiums presented at the recent annual meeting of the National Association of Corrosion Engineers in Chicago.

Technical papers included are: "Corrosion in Sweet Oil Wells," by H. E. Greenwell, Atlantic Refining Co., Dallas; and "Corrosion of Casing in Oil and Gas Wells," by Jack L. Battle, Humble Oil & Refining Co., Houston.

Committee reports and discussions serving as other source material originated from N.A.C.E.'s technical committee, TP-1, on corrosion of oil and gas-well equipment.

. . . Sweet-Oil Wells

APPROXIMATELY 30 per cent of the country's low-pressure sweet-oil wells are "economically affected" (annual cost of corrosion, $200 or more) by water-dependent corrosion. The annual cost of corrosion is $960 per well, even with remedial measures.

The average low-pressure corrosive well experiences 11 years of relatively trouble-free operation before corrosion sets in. After corrosion starts, tubing life is reduced to an average of 3 years, and may be as low as 6 months.

The average low-pressure corrosive well is produced from a depth of 5,050 ft., with average bottom-hole pressure of 2,275 psi. Average bottom-hole temperature is 160° F.

Previous papers[1,2] have summarized water-independent corrosion which occurs at high pressures, usually from the beginning of the well's production history.

Relationship to water production . . . Only a small proportion of low-pressure wells producing less than 40 bbl. of water per day are corrosive, while 75 per cent of those making greater than 100 bbl. of water per day are corrosive. However, there is no direct correlation between volume of water produced and corrosion. Distribution of wells between these limits of water production into corrosive and noncorrosive categories is random.

Wells making large amounts of water usually have high lifting costs, and the added burden of corrosion expenditure can result in operation at a loss. Too, expenditures to repair corroded equipment are not the total economic loss, since down time to make repairs in many high-water production fields results in loss of production.

Water-oil ratio has a primary influence on whether a given well in a corrosion-susceptible field is corrosive. Figures on a number of corrosive fields show:

Per cent water	Per cent of wells corrosive
0-20	0
20-40	18
40-60	44
60-80	25
80-100	85

Thus there is a critical water-oil ratio below which corrosion does not occur. This ratio is greater than 40 per cent water for most fields.

Corrosion-susceptible field . . . Corrosion tendency in a field may be traced to presence of naturally occurring carbon dioxide and fatty acids. Carbon dioxide causes severe pitting attack, and is usually considered the primary

cause of corrosion. Rate of reaction does not decrease with time, since no insoluble primary corrosion products are formed. Presence of fatty acids should be regarded as a contributing factor rather than a primary factor. However, severe corrosion occurs in some wells in which fatty acid concentrations are 1,000 to 1,500 p.p.m., at low partial pressures of carbon dioxide.

More or less severe corrosion has occurred in some fields where neither fatty acids nor carbon dioxide have been detected. It is therefore probable that there are additional undiscovered corrosion causative agents in some production.

The opportunity to corrode is governed by the wetting tendency of the oil and the relative amount of water present. The wetting tendency of a given oil does not appear to vary with the percentage of oil. With a given wetting tendency, the film of protective oil is overcome at some ratio of water to oil, designated as the critical ratio. Critical water-oil ratio will vary widely from field to field, even though the same amounts of causative agents may be present. As yet, however, critical water-oil ratio cannot be predicted from wettability data.

Undoubtedly there are complicating factors, such as mechanical scouring, which cannot be measured easily.

Based on present knowledge, it is not possible to define the severity of a corrosion problem in terms of the concentration of its causative agents. Development of such correlations presents troublesome aspects:

1. Concentration of carbon dioxide in the gas is not a reliable index to down-hole acidity, due to the complex phase behavior of oil, water, and gaseous mixtures at bottom-hole conditions.

2. Iron content of a produced water cannot ordinarily be related directly with degree of corrosion. In one field, 0.5 lb. iron per day per well may signify severe corrosion, while in another, 5 lb. iron per day per well may be little cause for alarm. One reason for this is that iron of "natural origin" may be produced in any well producing bottom water. Another is that it is very difficult to obtain representative well-head samples. In certain wells, some iron is deposited out before the produced stream reaches the well head, due to a rise in pH as surface conditions are approached.

Use of coupons . . . The use of surface flow-line coupons has not proved successful in determination of water-dependent sweet-oil-well corrosion, since most such wells are not corrosive at the surface. This fact alone is strong proof that carbon dioxide is the principal causative agent.

Better results have been obtained when the coupons were exposed at various depths in wells. By all indications at the surface, two example wells are noncorrosive. Coupon data from these wells show the following:

Depth, ft.—	Penetration, in. per year	Per cent water
Well 1:		
6,000	0.0479	55
4,000	0.0194	
2,000	0.0068	
Well 2:		
6,000	0.0212	10
4,000	0.0025	

The technique of using subsurface coupons is described elsewhere.[3]

Metallurgical factors . . . No corrosion problem is independent of the properties of the metal being corroded. Severe "ring worm" corrosion of tubing has been observed in wells producing some 30 per cent water. Other wells in the same field show no corrosion at water concentrations of less than 50 per cent.

Serious attack of macaroni strings employed in certain gas-lift schemes has been experienced. These wells suffered no corrosion of other in-hole equipment, and the problem was eliminated by removal of the macaroni strings. Small sizes of pipe have been troublesome from the corrosion standpoint for many years.

These troubles have been significantly reduced as properties necessary for less corrosion susceptibility have been better understood. It is probable that they can be reduced to an insignificant value.

Other factors . . . It has not been possible to determine corrosion tendency in terms of method of production. While gas lifting aggravates corrosion in some fields, no general conclusions can be drawn.

Oil wells associated with corrosive gas production usually are corrosive. The corrosion tendency of the reservoir is disclosed early in the life of the gas wells. The oil wells become susceptible only when the oil no longer affords protection to the steel. Thus forewarned, the oil wells can be observed with the thought that corrosion is almost inevitable sometime during production. When it becomes possible to predict both reservoir performance and the critical water-oil ratio, corrosion can be anticipated long before it becomes actuality.

After corrosion begins, it is by no means an unvarying quantity. Some fields show a peak of corrosiveness, the corrosion increasing to a maximum and then declining. This is quite apart from the change in corrosion with the usual variables. This behavior probably results from the combined effects of several changing quantities, including gas-oil ratio and gas-water ratio. In numerous instances the corrosiveness becomes more pronounced as gas-oil ratio increases.

Preventive Measures

Chemical inhibitors constitute the most widely employed preventive measure. One operator treats a large group of wells by injecting inhibitor into the gas-lift system. Adsorptive-type chemical is batched into the lines daily in accordance with this schedule:

Per cent water	Quarts chemical per day
50-65	½
66-75	1
76-80	1½
80	2

Good protection has been obtained by this treatment since it was started in 1949. None of these wells is equipped with a packer.

A similar procedure was not satisfactory on gas-lift wells equipped with packers. Good protection was gained in the tubing down to, but not below the bottom valve, in this group of wells producing 80 to 90 per cent water.

Stick-type inhibitors have been used successfully in a large number of wells. Frequency of treatment and shut-in time following treatment vary widely, and no generalization can be drawn as to optimum technique. In general stick treatment appears to be more expensive than application of liquids.

Certain adsorptive-type inhibitors have proved effective as emulsion treating chemicals. In some instances, additional treatment to remove water is unnecessary. Some of these inhibitors may have a certain detergency toward paraffin. Some fluids treated with inhibitor seem to be less viscous than normal, with certain flow advantages resulting. Deposition of mineral scales has seemingly been reduced. While these effects cannot be predicted in advance, they should be watched for when an inhibitor program is put into effect.

Wetting agents . . . The percentage of water at which the water-oil ratio becomes critical may be increased by adding a wetting agent to increase the wetting power of the oil.[4]

Wettability may be measured by the "drop-size ratio" technique. A small drop of oil is released in a cell filled with the produced water. The drop is held captive under a small steel plate

which is immersed horizontally in the water. The shape of the captive drop will depend on the degree to which it wets the steel surface. The drop will be perfectly spherical if there is no wetting. The drop will flatten or spread out, according to the wetting power of the oil. The flatter the drop, the more oil wetting is taking place.

Various wetting agents or combinations of agents are tried until the formula which gives the most economical drop size reduction is found. Field experience with this approach has been successful. This method is less cumbersome than the indirect evaluation methods required for some types of inhibitors. Well treatment is predicted in advance, and economics of the treatment are known before any chemical has been used. Frequently the minimum phase (oil) is being treated. Thus economics seldom become unfavorable due to increasing volume of water.

Many agents must be tried for each system, however. Specialized equipment and procedures must be employed. Each problem must be considered individually. A great amount of control work is required for effective use of wetting agents.

Sour-well corrosion . . . Data are available on 3,000 sour wells, 2,400 of which are corrosive. Of the 2,400, 2,100 are produced by pumping. Less than 50 bbl. of oil per day is produced by 2,200 of these wells. Most trouble is encountered when water production is 0-20 or 80-99 per cent of total production.

Inhibitors are used in 1,500 of the 2,400 wells. Average daily cost for inhibiting treatment is 50 cents, varying from 4 cents to $1.85. The average cost figure of 50 cents has been substantiated by other studies.

One operator reports savings of $50 per well per month by inhibiting sour wells in Kansas. This operator is not able to correlate corrosion with hydrogen sulfide or water content. All wells are treated after equipment failures occur, or when ferrous sulfide is detected.

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3. D. A. Shock and J. D. Sudbury, "Corrosion Control in Gas Lift Wells," Corrosion, 8, No. 9, 296, September 1952.
4. W. F. Rogers and H. E. Waldrip, "Results of Some Studies of the Condensate Well Corrosion Problem," Corrosion, 3, No. 3, 121, March 1947.

. . . In Oil-Well Casing

APPROXIMATELY 27 million tons of steel, worth some 5 billion dollars, are utilized in the production strings of United States oil wells. All this tubing is subject to more or less severe corrosion. As a result considerable attention is being given to mitigation of this corrosion.

Magnitude of problem . . . Data are available on 123 casing failures which occurred in 22 fields during the years 1949 through 1951. Repairs cost $867,256. The survey includes 7,126 wells of the total 45,830 wells in the fields. Assuming the same failure frequency on the wells not surveyed, total failures may be estimated at 646, with repair costs of approximately $6,600,000.

Similar extension to all fields within the United States is not practical, but the magnitude of the problem is evident.

Stray currents and aggressive fresh waters were the most frequent causes of failure in the 123 cases reported, with acid-gas vapor-zone attack not far behind. Corrosion by bacterial action was also significant.

One company made a study of all casing failures in operations during the interval, 1941 through 1950. The study revealed that 79 per cent of all failures were caused by corrosion. Most failures resulted from external corrosion of casing by formation waters. Other causes were flow of stray currents and contact with acidic gases.

Repair of the 238 failures due to corrosion cost $1,097,014, or approximately $4,600 each.

Preventive measures . . . The installation of insulating flanges to isolate the well head and subsurface equipment from the flow line to eliminate surface stray currents has been effective in many fields. Sharp reduction in failures was noted in the Loudon, Talco, and Tomball fields. This measure is less effective where soil resistivities are low, or where electrolysis results from subsurface currents.

The setting of packers and the loading of the annulus with alkaline freshwater muds or nonvolatile inhibitors in crude oil is widely practiced to eliminate internal-vapor or fluid-zone attack from acid gases and waters. The intermittent or continuous lubrication of such inhibitors into the annulus of pumping wells is also widely practiced and effective. Use of volatile inhibitors in the annuluses of wells having fluid seals shows promise.

The use of cathodic protection to control external attack is receiving intense study, with some 225 wells in a West Texas field and wells in several East Texas fields being investigated. Results indicate that cathodic protection can be obtained to a depth of 6,500 ft. at current densities of 0.03 ma. per sq. ft.

The casing potential log has been used to study surface and subsurface currents in wells and to investigate the effect of the application of cathodic protection at the well head.

Problem Areas

A recent survey in East Texas field showed 80 per cent of casing failures of known depth to have occurred above 400 ft., with 62 per cent between 200 and 325 ft. The most serious corrosive attack occurs over an interval of 50 to 75 ft.

A corrosive fresh-water sand is known to exist over the major portion of the field, at a depth of 150 to 300 ft. This water contains approximately 100 p.p.m. total solids, relatively high iron and carbon dioxide contents, and possesses a pH value of 5 to 6 immediately after being produced at the surface.

In addition, bacterial action is indicated. Surface and subsurface currents may be present. All three factors are probably involved in the corrosive action.

To prevent contact of the casing with the corrosive waters, one operator has placed alkaline mud behind the casing in five wells to a depth below the zone where leaks normally occur. This treatment should also prevent bacterial action.

This operator has estimated that at least 750 of its wells in this area will develop casing leaks before the reservoir is depleted. Total approximate repair cost using patch tools is $3,225,000. Alkaline mud treatment costs about $200 per well. Total cost is thus reduced to $150,000.

West Texas-New Mexico . . . Casing failures have been widespread in this area in recent years. One company estimates that some $5,000,000 would have been spent on its wells alone if no preventive measures had been adopted.

Predominant attack is confined to the vapor space of the wells. Corrosion probably results from condensation of

moisture on the wall of the casing opposite water sands. The acidity of the condensed water is a function of the concentrations of carbon dioxide and hydrogen sulfide, and the total pressure in the annular space.

The most widely accepted program of prevention involves the setting of tubing packers and the loading of the annulus with water-free crude oil containing 1 to 2 gal. of inhibitor per 100 bbl. of oil. Volatile inhibitors such as anhydrous ammonia are also being introduced into the annuluses of wells in which there is a fluid seal. One operator reports the presence of ammonia vapor in the annular space 9 months after a batch injection.

The continuous or intermittent lubrication of adsorptive and wetting-type inhibitors is practiced by some operators in pumping and gas-lift wells. This method has the advantage of protecting both casing and tubing.

The average cost of setting a packer in wells in the area is $1,000, while cost of repair of a casing failure averages $25,000.

Kansas-Illinois . . . Numerous failures have occurred from internal attack of acid gas in the vapor zone in Bemis-Shutts and Iuki-Carmi fields of Kansas. Even a greater number of failures have occurred at shallow depths, due to external attack of casing by aggressive waters in the Dakota sand section in Trapp, Dorr, Kreuger, and Morel fields.

These failures are usually repaired by squeezing cement at an average cost of $3,000.

California . . . Failures in Ventura field of California are attributed to bacterial action. Since highly alkaline environments are known to stifle bacterial activity, the use of highly alkaline muds in the drilling of all new wells has been adopted as standard practice.

Other areas . . . An abnormal number of casing failures have been reported in Colorado field of Jim Hogg County in the lower Texas-Gulf Coast area. This field produces from the Cockfield sand at 3,200 ft. It is a solution gas-drive sand and produces a sweet crude with no salt water.

Nine casing failures have occurred at depths of 1,450 to 1,550 ft. On abandonment of one of the wells, 1,128 ft. of casing was recovered. The casing was in essentially new condition internally. Externally, it was covered with a ¼-in.-thick cake of greenish-black slime in which ferrous sulfide was present. The presence of sulfate-reducing bacteria was confirmed by laboratory examination. Removal of the slime revealed extensive corrosion damage.

Repair Procedures

The setting of a tubing packer below the point of leakage in the casing is the most economical method of correcting a casing failure. It can normally be accomplished for $1,000 per well or less; however, it is the least satisfactory method, except for temporary repair. The point of failure is not sealed, and corrosive fluids are admitted to the annulus to attack the tubing and packer element.

The setting of an inside liner to total depth is practiced in areas where original casing size will permit. The cost of running an inside liner varies with depth and availability of steel, but may cost from $5,000 to $35,000.

The squeeze cementing of a casing leak is accomplished by pressure application of the cement to the point of failure. The cement is driven into the point of failure and into the formation. This is the most frequently used and successful method of repair, and is usually accomplished at a cost of $3,500 to $7,500.

Replacement of the damaged casing with new pipe using the casing bowl or patch-tool assembly involves setting a plug below the point of failure, mechanically cutting the casing below damage point and recovering it, and rerunning new pipe with the patch tool. A seal is made between new and old casing members by means of casing slip and packoff element.

Preventing failures . . . The following procedures are suggested to prevent failures:

1. Evaluate the corrosive characteristics of new fields early in order that suitable mud and cementing programs can be adopted.

2. Install insulating flanges in the flow lines of all new wells completed as producers unless previous surveys have indicated such flanges are unnecessary.

3. Install insulating flanges in all wells in old fields in which flow-line-current surveys and the remaining reserves of the field indicate such action would be economical.

4. If casing recovery is obtained in areas where corrosion failures of casing have occurred, have a qualified corrosion engineer present to examine the casing at the well site immediately following its recovery from the well bore.

5. Make full use of volatile and non-volatile inhibitors in wells known to be corrosive.

6. Examine all recovered subsurface equipment thoroughly for corrosion and maintain complete description and cost data on damaged equipment.

7. Eliminate the use of perforated tubing, couplings, and orifice buttons as a means of protection in every instance possible. Consideration should be given to the incorporation of reverse check valves in all gas-lift valves.

. . . Organic Inhibitors in Condensate Wells

THE use of organic inhibitors is currently the preferred method of controlling corrosion in condensate wells, according to a survey made of 450 wells in 70 fields. The cost of controlling corrosion in this manner varies rather widely by fields and by operators. It runs from $200 to $1,400 per well per year and averages $600 to $700 per well per year. These reported costs vary from about $0.40 to $2.00 per M.M.c.f. of gas produced.

Liquid inhibitors . . . The technique of periodically dumping liquid organic inhibitors into the top of the tubing where tubing is set on packers or into the annulus of dual or triple-completed wells is gaining in popularity. Three makes of liquid inhibitor appear to be proved in field use and two other makes are being used experimentally with encouraging results. The frequency of injection varies considerably, but it appears that weekly injections are used most frequently. Some operators treat wells daily, a few wells are treated once a month, and the trend appears to be toward treatment twice per month.

One of the widest variations pertains to dilution of the chemical. Some operators do not dilute chemical and allow the well to remain shut in 6 to 8 hours, while others dilute with either water or hydrocarbons and keep wells shut in for 1 to 2 hours. In cases where the

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well is kept shut in for only 1 hour, 1 gal. of chemical is diluted with 10 to 20 parts of diluent.

Generally, good success has been reported from these treatments with only a few failures mentioned. Judging by caliper surveys and coupon tests, 90 per cent or more success is reported. Judging by iron contents of the produced water, the success is evaluated at 75 to 80 per cent. Most operators find that the iron content is readily reduced to below about 50 p.p.m. A large number of iron contents are less than 20 p.p.m. It appears customary when treatment is first started to use approximately 1 qt. of chemical per M.M.c.f. of gas produced. The amount is frequently reduced after 1 or 2 months' treatment to as low as ½ qt. per M.M.c.f.

Stick inhibitors . . . Organic inhibitors in stick form are in rather wide use in isolated wells or in fields where only a few wells needed to be treated. The chemical cost of using chemical in stick form is slightly higher than that for liquids. The results being obtained are comparable with those obtained with liquid organic inhibitors. The amount of chemical used and the frequency of injection vary but are comparable with liquid inhibitors.

Typical Case Cited

A typical case is a company that has been treating six wells for the past 4 years. Two sticks twice per week were used in wells producing 1.8 to 4.0 M.M.c.f. per day. The iron content was reduced from 300 p.p.m. to 30 p.p.m. or less. In this field, adjustable choke parts are now being changed approximately every 2 years, in comparison with every 30 days before treatment started. Three makes of sticks are being used, although two of the makes have been in use a relatively short time. One operator reports that sticks will satisfactorily drop in wells flowing at a rate of 1.5 to 2.0 M.M.c.f. per day.

Little information along this line is available but previous tests indicate that it is preferable to keep wells shut in for an hour or so after injection of sticks. One operator reported using sticks once per week in three wells in one field. The results are as good as more frequent injection.

Side effects . . . The principal undesirable side effect reported was emulsification caused by inhibitors. In most instances, this has been overcome by changing to chemicals which do not cause serious emulsification. In one case, it was reported that an emulsion breaker was added ahead of a low-temperature unit to prevent emulsification and/or wax trouble in the separator. In several cases reducing the amount or reducing the frequency of injection reduced the emulsifying tendencies.

Some batches of one of the inhibitors that has been used very satisfactorily in the past have been found to polymerize further under the temperature conditions existing in wells. This makes its use objectionable in wells in which velocity valves are set in the tubing string, and it also would be objectionable in cases where chemical is injected through a macaroni string or through the casing via a valve in the bottom of the tubing string.

Continued polymerization of an inhibitor dumped into the tubing may be advantageous in regard to tending to plug incipient tubing thread leaks. Inhibitor manufacturers are currently improving and changing chemicals to eliminate undesirable side effects, but

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it behooves operators to stay alert to this phase of the problem.

Accumulated data on corrosive condensate wells producing salt water indicate that salt-water production does not reduce the success of inhibition obtained with organic inhibitors. The data are not conclusive at the present time and it appears necessary to keep this under observation.

Multiple-completed wells . . . From the results obtained on use of organic inhibitors in the annuli of about 30 dual and triple-completed wells, it is apparent that periodic injection of organic inhibitors is a practical solution to the corrosion problem, as judged by the iron content of the produced water.

On the average, the wells are treated once per week and, probably because of the importance of keeping casing in such wells in good condition, operators tend to use approximately 50 per cent more chemical in the annulus than they do in the tubing string. The chemical injected into the annulus well is usually diluted, although some chemical is being injected in some fields without dilution.

Chemical injection methods . . . Several companies are trying special valves in the bottom of tubing strings to permit injection through the annulus in condensate and in oil wells. The chemical is diluted with approximately 40 parts of crude oil or other hydrocarbon. Generally, these valves are operating satisfactorily. Trouble was encountered by one operator by the polymerization of one certain chemical which resulted in plugging of the injection-valve assembly.

The injection of chemical by slugging is accomplished by either gas-driven or mechanically driven pumps having an injection rate of approximately 1 bbl. per hour against 5,000 psi. pressure. The cost of pumps mounted on trailers or in trucks to accomplish injections at such rates and pressures is relatively high. One operator reports the start of tests using a low-cost, mechanically driven, radial, piston-type pump capable of doing this work. The size, weight, and cost of such a pump assembly make it desirable.

Special materials . . . Valves and fittings made of 11 to 13 per cent chrome steel are satisfactory in sweet condensate wells. One operator has three strings of 9 per cent chrome tubing on order.

Use of plastic-coated steel tubing indicates that the materials installed in the last 3 years are in essentially new condition, as revealed by caliper surveys.

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Gas-Oil-Ratio Control . . .

in Thin Oil Columns

Use of intermitters means increased oil recovery for entire life of well. More even pressure distribution is obtained, thus providing for more effective drainage and more regular advance of gas-oil contact plane.

by Robert C. Randle*
and
Jacques H. Marchal*

A THIN oil column will be defined as an oil reservoir presenting the following characteristics:

1. The oil reservoir appears as a ring or a part of a ring around, and in communication with, a relatively large gas cap.

2. Gas-cap drive is the major source of energy, with solution drive existing as a minor driving mechanism; water drive may be present but its effect is always negligible compared to that of the gas cap and the solution gas.

3. Major production problem is the control of the flow of gas through the reservoir.

Thin oil column reservoirs can be classified according to four of their most important characteristics:

1. Ratio of the original acre-feet of the gas cap to the original acre-feet of the oil reservoir.

2. Distance from the gas-oil contact to the water-oil contact and the dip of the structure.

3. Thickness of the sand.

4. Original bottom-hole pressure at gas-oil contact and solution gas-oil ratio.

These characteristics are related and one may vary quite widely as long as the others vary accordingly. For example, a reservoir may still be a thin oil column if the ratio of acre-feet is only one; but, in this case, the distance between contacts must be at a minimum, probably no more than one location wide.

The group of reservoirs from which the examples appearing in this paper were obtained have the following general characteristics:

1. Ratio of the original acre-feet of the gas cap to the original acre-feet of the oil reservoir varied from one to seven.

2. The distance from the original

*Authors with Magnolia Petroleum Co., Falfurrias, Tex. Paper presented at spring meeting, Southwestern District, A.P.I. Division of Production, Fort Worth, March 5-6, 1953.

BEFORE INTERMITTERS (TABLE 1)

Well	Date	Choke size (in.)	Avg. tbg. flowing pressure (psi.)	Gas-oil ratio	Allowable (actual)	Flowing period
A	7- 5-51	5/64	1,250-1,400	4,200	*34	
B	2-16-52	5/64	1,100	6,900	†19	
C	5-10-51	8/64	600	5,100	*24	
D	4- 3-52	4/64	1,650	17,000	*8	
E	1- 8-52	6/64	1,375	93,000	*1	
F	3-10-52	5/64	1,050	8,600	*14	
G	1-16-51	6/64	1,300	5,100	*33	
H	9-14-50	7/64	1,100	21,000	*9	
I	8- 3-50	4/64	900	3,200	†19	
J	10- 7-50	5/64	1,200	14,000	*8	

AFTER INTERMITTERS (TABLE 2)

Well	Date	Choke size (in.)	Avg. tbg. flowing pressure (psi.)	Gas-oil ratio	Allowable (actual)	Flowing period
A	8-14-51	10/64	1,250-1,500	2,900	†26	10 min./1 hr. (24 hr.)
B	3-12-52	12/64	800-1,200	2,300	*59	2 hr./6 hr. (24 hr.)
C	7-24-51	1/4	200- 800	3,400	†22	14 min./1 hr. (24 hr.)
D	5- 1-52	12/64	2,300	6,000	*22	1 hr./3 hr. (24 hr.)
E	2-15-52	1/4	1,550-1,650	6,300	*22	10 min./30 min. (24 hr.)
F	3-25-52	12/64	1,700-2,200	6,800	*18	2 hr./6 hr. (24 hr.)
G	3-20-51	10/64	1,450-1,500	4,000	*42	21 min./1 hr. (20 hr.)
H	11-14-50	12/64	1,300	11,000	*16	7 min./30 min. (24 hr.)
I	9-17-50	1/4	850	4,600	*29	No record
J	11-17-50	8/64	650	14,000	*8	16 min./1 hr.

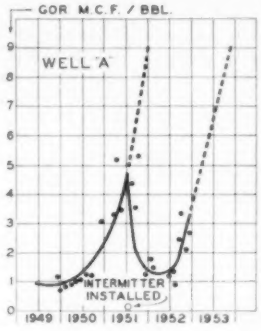
ON JANUARY 1, 1953 (TABLE 3)

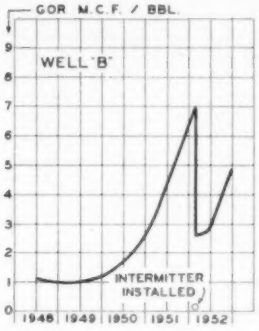
Well	Date	Choke size (in.)	Avg. tbg. flowing pressure (psi.)	Gas-oil ratio	Allowable (actual)	Flowing period
A	1-1-53	9/64	1,250-1,375	2,700	†14	5 min./30 min. (14 hr.)
B	1-1-53	12/64	700-1,700	4,400	*31	3 hr./12 hr. (24 hr.)
C	1-1-53	1/4	675-1,750	6,300	*19	2 hr./8 hr. (24 hr.)
D	1-1-53	11/64	2,000	10,000	*13	1 hr./4 hr. (24 hr.)
E	1-1-53	12/64	1,600	39,000	*3	7 hr./24 hr.
F	1-1-53	5/64	1,000	8,000	†10	2 hr./4 hr. (24 hr.)
G	1-1-53	10/64	1,350-1,475	17,000	†8	7 min./30 min. (24 hr.)
H	1-1-53	13/64	850-1,250	5,500	†15	1 hr./3 hr. (24 hr.)
I	1-1-53	6/64	975	10,000	†12	Stopcock removed
J	1-1-53	8/64	800	16,000	*7	Stopcock removed

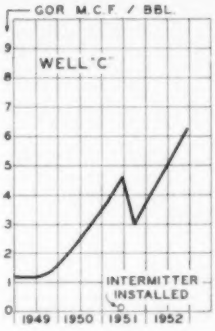
SUMMARY OF ALLOWABLE CHANGES (TABLE 4)

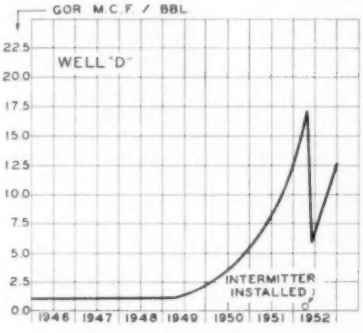
Well	Before intermitter		After intermitter		Present status	
	Date	Allowable	Date	Allowable	Date	Allowable
A	7- 4-51	*34	8-14-51	†26	1-1-53	†14
B	2-16-52	†19	3-12-52	*59	1-1-53	*31
C	5-10-51	*24	7-24-51	†22	1-1-53	*19
D	4- 3-52	*8	5- 1-52	*22	1-1-53	*13
E	1- 8-52	*1	2-15-52	*22	1-1-53	*3
F	3-10-52	*14	3-25-52	*18	1-1-53	†10
G	1-16-51	*33	3-20-51	*42	1-1-53	†8
H	9-14-50	*9	11-14-50	*16	1-1-53	†15
I	8- 3-50	†19	9-17-50	*29	1-1-53	†12
J	10- 7-50	*8	11-17-50	*8	1-1-53	*7
Total		**169**		**264**		**132**
Weighted gas-oil ratio		**7,700**		**4,800**		**8,300**

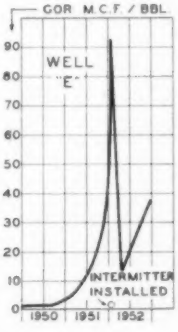
*Restricted due to gas-oil ratio in excess of 2,000 cu. ft. per bbl. †Restricted due to limited capacity of well.

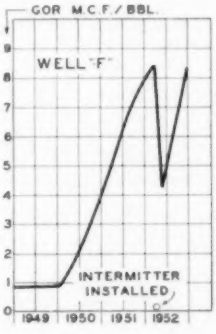


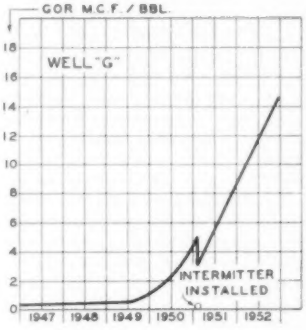


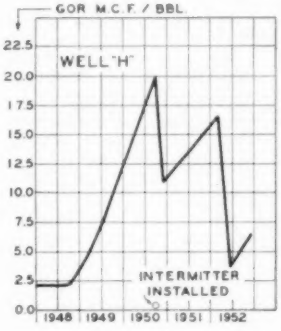


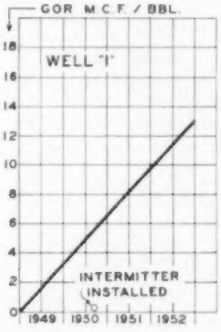


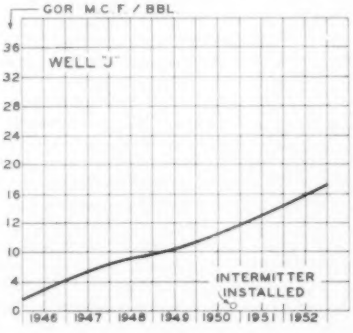












G. O. R. CASE HISTORIES

INTERMITTER INSTALLATIONS helped 8 out of 10 of these wells. Before intermitter installation, these 10 wells were producing 169 bbl. per day, with a weighted gas-oil ratio of 7,700 to 1. After the installation, the production rose to 264 bbl. per day, while the weighted gas-oil ratio decreased to 4,800 to 1. The wells are now producing 132 bbl. per day, with a weighted gas-oil ratio of 8,300 to 1. Fig. 1.

gas-oil contact to the original water-oil contact varied from 500 to 2,500 ft. when projected from a sand dipping an average 300 ft. per mile.

3. Thickness of the sand varied from 20 to 80 ft.

4. The original pressure at the gas-oil contact and the solution gas-oil ratio varied respectively from 2,800 to 3,700 psi. and from 700 to 1,000 cu. ft. per barrel.

These sands are all Frio sands of Oligocene age, having an average porosity of 25 to 30 per cent and an average permeability ranging from 100 to 400 md.

Primary Production History of a Thin Oil Column Reservoir

The existence of a relatively large gas cap indicates that the oil is saturated and the bubble point is at the original pressure; this fact controls the entire production history of such a reservoir under competitive primary operations.

The history of a typical reservoir of this type can be briefly summarized as follows:

As soon as the first barrel of oil is produced, the bottom-hole pressure starts declining, the gas cap expands, and the gas-oil contact starts moving toward the water-oil contact. At the same time part of the solution gas escapes from the oil and the gas saturation starts to build up throughout the zone. It should be noted that there can be no movement of this gas toward the gas cap or the wells until the gas saturation reaches the minimum gas saturation for the existence of gas relative permeability.

This is a period of low-gas-oil-ratio production. All the wells flow, the pressure drop per barrel of oil produced is at the lowest, and no special production problems are encountered.

A second stage starts when the gas saturation reaches the point at which the gas relative permeability is no longer zero. The gas starts to flow and the gas-oil ratio increases; first from the wells closest to the gas cap because only here is the necessary differential available for gas flow from the gas cap to the wells. Eventually all the wells reach the status of a gas well and the ultimate production under primary has been obtained. It is during this second stage that the overwhelming problem of control of the produced gas-oil ratio is encountered.

The ultimate recovery can vary greatly. Recovery from a high-pressure sand, with a high solution ratio, a small distance between the gas-oil and water-oil contacts, and a low minimum gas saturation for the zero point of the gas relative-permeability curve, may be as low as 5 or 6 per cent or the oil originally in place. In this case a small decline in pressure will liberate a lot of gas and as a small gas saturation will allow gas to flow, the gas-oil ratios will increase rapidly, and relatively little oil will be recovered before the wells become gas wells.

On the other extreme, if the gas cap is very large, the pressure relatively low, the distance between the contacts large enough and the minimum gas saturation for gas flow, high, the primary recovery may be as high as 50 per cent of the original oil in place.

The ultimate recovery for a group of reservoirs under study appears to be approximately 25 per cent of the oil originally in place.

This history would not be complete without mentioning the time involved in depleting such a reservoir. The first stage is relatively short, varying from 1 to 5 years, while, according to some of the detailed reservoir studies that have been made, the more expensive second stage may last 40 years or more. These figures assume production operations conducted under the present gas-oil ratio penalty system of the Texas Railroad Commission.

From an economic standpoint, the recovery from such fields is very sensitive to the posted price of crude as the last 20 years of operations are conducted under unfavorable conditions, i.e., production of a few barrels per day per well with rising operating costs.

This is the average history of a thin oil column type of reservoir. A great many local problems can be created by such things as gas coning as a result of poor permeability distribution but this paper will not discuss these problems because they are not specifically that of a thin oil column. It should be noted, however, that they may not be negligible in the over-all production history of a specific reservoir.

Control of Produced Gas-Oil Ratio

Our aim as oil producers is to obtain the largest possible recovery from any oil reservoir and a thin oil column presents a very interesting challenge because there are possible, relatively simple theoretical ways of increasing this recovery.

These can be classified in the following broad categories:

1. The approach to the problem on an over-all reservoir basis—unitization and pressure maintenance.

2. The approach through the individual wells—mechanical control of the gas-oil ratio.

Unitized operations . . . The most effective method of recovering oil from any reservoir and particularly from a thin oil column is by the most efficient use of the available reservoir energy. Obviously this can best be attained through unitization.

If unitized operations can be accomplished early in the productive life of the reservoir, much advantage can be gained in strategic location of wells and prevention of overdrilling, particularly in fields that are divided into many small leases. A completely successful operation would provide for the complete depletion of the oil reservoir between the original pressure and the "critical gas saturation pressure" or the pressure below which the gas saturation will have increased enough to permit gas to flow through the reservoir. Even though energy is abundant, it is essential that it be kept at or close to its peak throughout the depletion of the oil reservoir. Reinjection of the produced gas will generally be sufficient to maintain the pressure above the critical gas saturation pressure.

Other fluid-injection methods may be used when feasible. Conventional methods of water flooding will often prove uneconomical because of the configuration of the reservoir; but when possible, should result in high recovery. Nature occasionally provides a reservoir with all the characteristics of a thin oil column plus a very active water drive; the pressure is maintained, the gas-oil ratio does not increase, the recovery is very high, and the lifting cost stays low.

G.O.R. of individual wells . . . To increase the recovery of a reservoir through management of individual wells is very difficult because the operators does not have any control over the over-all balance of reservoir fluid saturations as in the case of unitized operations. His basic aim, however, is the same as under unitization, viz., to maintain the reservoir in the liquid phase and to insure an even movement of the gas-oil contact plane through the oil zone.

Consider the case of an individual well. Pipe has been set through the sand and selectively perforated as near the water-oil contact as possible. The stage of low ratio production has passed

"Low cost, quick payout, and increased ultimate recovery make intermitter a valuable tool."

and it has become necessary to investigate all possible methods of reducing the gas-oil ratio.

The possibility of reducing the gas-oil ratio depends upon the basic cause of the increase, viz.:

1. Whether the gas-oil contact is at or close to the perforations as a result of natural encroachment of the gas cap or of coning.

2. Whether the gas saturation around the well bore has increased because of the drop in pressure throughout the reservoir and the greater drawdown immediately around the well bore.

In the first case the only solution is to work over the well to move the perforations as far from the gas-oil contact as physically possible. This type of workover has been used extensively in the fields under study. An analysis of more than 100 workovers of this type indicated that no worthwhile reduction of the gas-oil ratio can be accomplished unless a shale break or impermeable barrier exists within the sand below the original perforations. If such is the case, success can be obtained by squeezing the original perforations and reperforating the sand below the shale break. Little or no success has been attained in squeezing and reperforating clean sands in which no breaks occurred.

In the second case, increase of the flowing bottom-hole pressure of the well can be attempted in order to reduce the gas saturation and thus the flow of free gas to the well bore.

When oil and gas flow in separate phases through the reservoir to the well bore, the productivity index of the well will vary with the gas-oil ratio. Control of the gas-oil ratio becomes the determination of the rate at which the productivity index will remain the closest to the original productivity index of the well.

The pressure on the face of the sand will have to be increased to reduce the gas saturation.

If the original productivity index of the well was high, it has been our experience that a reduction in the size of the choke will usually produce the desired results unless correction is attempted after the ratio has reached 20 times the solution gas-oil ratio or more; in this case, benefits can be so small as to be unnoticeable.

If the original productivity index of the well was low, it has been our experience that intermittent flow gives the best results.

Intermittent flow is designed to maintain the pressure in the sand within the interference sphere of the well. If the average flowing pressure can be increased in that area, the gas saturation will be lowered, the differential pressure between the gas cap and the bore hole reduced, and the flow of free gas to the well decreased.

Intermittent flow will not reduce the gas-oil ratio permanently. The gas-oil ratio can be reduced to a new base at the time of the installation of the equipment but will start increasing again, generally, at the same rate as before. The intermitter merely sets a new origin for the gas-oil-ratio curve and from there the ratio will repeat its previous increases. This phenomenon can be observed in Fig. 1 (Wells A to G).

Occasionally a well will improve continuously for a long period of time and adjustment in the flowing rate can be made from time to time to obtain further reduction of the ratio as shown in Fig. 1, Well H. This is the exception rather than the rule; unfortunately, our experience does not record more than three instances in which permanent reduction could be achieved for more than 1 year.

Intermittent flow means that the well is produced only part of the time, usually for a short period of time each day on a relatively large choke.

A production cycle starts as the well is shut in. The pressure at the face of the sand increases and the fluid level in the tubing rises. The well is then opened and allowed to flow. After the oil in the tubing has been produced and the pressure on the face of the sand has declined, the producing gas-oil ratio starts increasing rapidly. The well is shut in just before the sudden increase in gas-oil ratio.

The equipment used is simple. A pressure-operated intermitter, commonly referred to as a stopcock, is installed in the flow line of the well. It consists of a motor valve operated by a pressure-sensitive diaphragm, which opens or closes the flow line, and a clock set to allow pressurization or relaxation of the diaphragm at predetermined intervals of time. Supply gas to operate the device is taken off the tubing, and is accumulated in a small cylindrical container or trap to allow entrained oil to settle out of the gas.

As will be seen from the examples to be discussed later, the intermitters do reduce the gas-oil ratio and, in Texas, this reduction means an increased allowable but does it mean increased recovery for the entire life of the well?

We believe that it does by allowing a more even pressure distribution throughout the reservoir and thus a more effective drainage and a more regular advance of the gas-oil contact plane. However, no calculations have been made to evaluate the benefit of this production method to the over-all recovery from a reservoir.

The low cost of such an installation, the quick payout through increased allowables, and the increased ultimate recovery makes the intermitter a valuable if imperfect production tool.

Examples of Intermitter-Equipped Wells

A few examples of the results of some of the installations of intermitters are presented below. The gas-oil ratio has been plotted against time to illustrate the success of each installation.

Not all installations give appreciable results. It is estimated that by eliminating from tryouts those wells that experience has taught us have little chance to benefit from intermittent flow, it is possible to decrease the gas-oil ratio of at least 80 per cent of the wells where such installations are made.

It is almost impossible to give an average improvement for all the wells as each well is a particular problem and responds in a different degree. However, some data will be given for the wells on which graphs have been prepared: these wells have been chosen because they represent a good cross-section of the 75 wells presently equipped with intermitters in our district. Thus, it is possible to estimate from these individual data the benefit that can be gained through this production method.

These data are self-explanatory, and appear on Tables 1, 2, and 3, and are summarized on Table 4.

Average gas-oil ratio curves have been drawn for each well listed on the table; these appear on Fig. 1.

From the tables and the graphs, the following observation can be made:

Out of the 10 wells that were studied, 8 showed an improvement after installation of intermitting equipment but 2 could not be improved. This is a good example of the kind of results that have been obtained.

The tables show that the production of some of the wells could not be maintained, even though the gas-oil ratio was substantially lowered. In the case of Well A, this is caused by the fact that the well has a low productivity index and the choice is really between a gain of a few barrels per day and rapid gas coning. In the case of Well C, the small drop registered might have been avoided by further testing. It should be pointed out, how-

"Equipment represents small investment and payout is generally rapid."

ever, that many of the stopcocked wells have limited capacity allowables because their oil production did not increase enough to equal what they would be allowed to produce under their reduced gas-oil ratio. In any event, conservation of reservoir energy is realized.

The testing of these wells for the selection of the proper cycle is the biggest drawback of this producing method inasmuch as continuous testing is necessary for at least a week before the proper cycle can be determined. In some instances, several weeks have been necessary because of the fact that the test has little value unless the well is fully stabilized under the flowing conditions of the test.

The gas-oil-ratio curves for each well have been drawn as an average of all tests available. They indicate the trend of the gas-oil ratio, but few individual tests can actually be read from them. All the available tests are shown on Well A, to give an idea of the value of the curve and what it actually represents. All tests appearing in the tables are 24-hour tests of each well after stabilization and they represent exactly the actual behavior of the well under the flowing conditions listed.

Best intermitter cycle . . . Originally a trial-and-error process was used to determine the most efficient cycle. This method has been improved and we are currently attempting to develop a standard procedure for arriving rapidly and economically at the best cycle.

The basic method involves the correlation of pressure behavior with oil production and gas-oil ratio. The measurement of the flowing bottom-hole pressure would be the best possible method; however, it is not a practical one and surface readings have to be used.

As an indication of our success, some of the data have been summarized in Table 4; before the installation of intermitters these 10 wells were producing 169 bbl. per day with a weighted gas-oil ratio of 7,700 to 1. After the installation the production rose to 264 bbl. per day while the weighted gas-oil ratio decreased to 4,800 to 1. At this date these wells are producing 132 bbl. per day with a weighted gas-oil ratio of 8,300 to 1. This decline cannot be compared with the decline of the field because the dates of installation of the intermitter were different on each well; however, the gas-oil-ratio curves show how the standings of the wells have been improved by the installation of the intermitters.

TABLE 5—PRODUCTION HISTORIES OF WELLS A AND C

Well	Cum. prod. on date of install. of intermitters	Reserves on that date by primary prod. without S/C	Est. ult. prod. by primary without S/C	Cum. prod. 1-1-53	Reserves as of 1-1-53	Est. actual ult. prod. of well by primary with S/C
A	38,600	11,000	49,600	48,000	17,000	65,000
C	27,500	29,300	56,800	37,200	25,200	62,400

Production History of Individual Well

As stated above no attempt has been made to evaluate the benefits of intermittent flow to an entire reservoir. However, the production data of 2 of the 10 wells listed in Table 1 were available and an attempt has been made to predict the ultimate recovery under conventional producing methods and under intermittent flow. Future production was calculated by integrating the penalty gas-oil-ratio formula used by the Texas Railroad Commission, that is:

Allowable production = Top zone allowable times penalty gas-oil ratio divided by actual gas-oil ratio.

The relationship between the actual gas-oil ratio and time had to be established for use in this formula. A straight-line function of time was used because the actual trend of the gas-oil ratio of the greatest number of wells studied followed such a line.

The production between time T_1 and T_2, the penalty gas-oil ratio having been surpassed at T_1, was written as:

$$P = \frac{A\,Gp}{a \log e}\left[\log\left(\frac{a}{b}T + 1\right)\right]_{T_1}^{T_2}$$

where:

P = production between T_1 and T_2
A = top zone allowable during unit of time
Gp = penalty gas-oil ratio
e = 2.71828
T = time
a = gas-oil ratio increase per unit of time
b = gas-oil ratio for T = 0

This equation has been used in calculation of ultimate recovery for an entire field and provided a reasonable check of detailed reservoir calculations.

Table 5 shows the production history of Wells A and C.

The intermitter installation shows an increase of 15,400 bbl. for Well A and 5,600 bbl. for Well C over depletion of the well by conventional producing methods. The rate of increase in gas-oil ratio for Well C after the installation of the intermitter was read from the curve in Fig. 1 as 2,600 per year.

It is believed that the actual rate may be lower when more time has elapsed and more tests are available to establish the actual trend. Assuming that the rate of increase after the installation was 2,000 per year instead of 2,600 per year, the increase in ultimate recovery would be 13,200 bbl.

Intermittent flow of high gas-oil ratio wells has been successful with the following limitations:

1. There is no sure way to eliminate before testing the 20 per cent of prospective wells that are not going to improve through this producing method.
2. The time necessary to test most of the wells is long. It is possible, however, that this time will be shortened through the development of better testing procedure.
3. The decrease in the gas-oil ratio is not permanent. It is merely lowered at the time of the installation and starts immediately increasing again at the same rate as before the installation.

The following benefits can be listed in favor of the operator:

1. The gas-oil ratio at the time of the installation can be reduced in 8 out of 10 cases through the installation of intermitters.
2. The allowable production can be maintained and, in most cases, increased; but its rate of decline from that day on will not change.
3. The equipment represents a small investment and payout is generally rapid.
4. The ultimate production of an individual well can be appreciably increased.

BOOK

A.S.T.M. STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS. With Related Information. Prepared by A.S.T.M. Committee D-2 on Petroleum Products and Lubricants. Published by American Society for Testing Materials, 1916 Race Street, Philadelphia 3. 831 pp. $5.75.

This 1952 compilation brings together in compact form most of the A.S.T.M. standards, test methods, and specifications widely used in this field. Products included are: crude petroleum, butadiene, motor and aviation fuels, petroleum solvents and naphthas, diesel fuels, distillate burner fuels, kerosine and illuminating oils, lubricating oils, turbine oils, electrical insulating oils, plant spray oils and petroleum sulfonates, lubricating greases, and petrolatums and paraffin waxes. A high percentage of the material included in the earlier editions has been revised and 10 of the methods are new. An important innovation is the use of Bible paper which provides a substantial reduction in the bulk of the book.

Mountainous Terrain Poses Tough Hydraulic Problems

(Continued from page 99)

Engines will burn Redwater crude oil which will be cleaned by centrifuge. Lubricating oil will be filtered.

Later on when capacity would be expanded from 120,000 bbl. to 200,000 bbl. daily, there would be three additional stations to be located as follows:

Future Expansion

1. Station near Jasper, Alta.
2. Station in the Birchland, and Black Pool, B. C., area, 67 miles northeast of Kamloops.
3. Booster station 65 miles west of Edmonton.

Housing . . . Except at certain isolated stations, operating employes will live in nearby towns in housing to be subsidized by the company. In planning the line an effort was made to locate stations near towns. Housing at isolated stations will be provided by the company.

Right-of-way acquisition . . . For the entire project the Trans Mountain organization had to deal with 2,700 individual land owners and 30 agencies of the dominion and provincial governments not including municipalities. On more than 500 miles of the route, timber estimating on the right-of-way had to be handled by licensed timber cruisers.

Communication . . . Communication for the system will be by leased wire facilities through arrangements with nearby railroads or by a combination of leased wire and medium frequency and V.H.F. radio.

Initial tankage will total 2,440,000 bbl. in capacity which will be equally divided between the Edmonton and Vancouver terminals. At each end of the line there will be six 150,000-bbl. and four 80,000-bbl. tanks.

Management . . . Trans Mountain is headed by Robert L. Bridges, president; S. D. Bechtel, chairman of the board; and H. H. Anderson, executive vice president.

The Trans Mountain system is being built under the direction of Canadian Bechtel, Ltd., headed by Van W. Rosendahl, president, and Donald L. Roberts, vice president. H. F. Waste is manager of engineering, and Ray L. Hamilton is consulting design engineer.

Model III Unit

The fluid catalytic cracking plant, referred to as a Model IV unit on page 262 of the March 23 issue, is actually a Model III unit.

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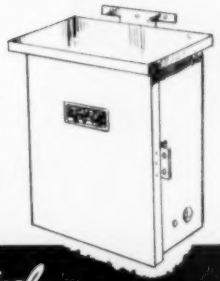

The Twentieth Century Phasing Unit improves power factor and utilizes all the protective devices of a standard motor controller. It is easy to install and easy to maintain . . . costs less as compared to single phase motors. There is no need to stock both three phase and single phase motors as spares. Now you need handle only three-phase motors. The Twentieth Century Phasing Unit incorporates many protective all-weather devices thus permitting operation at all times.

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Memorandum
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Came down to Caracas last night on a C&S "Connie." Reliable overnight 300 mph service, wonderful meals, free drinks and good-looking stewardesses.
These Connies can handle up to 8000 lb. cargo in the belly Speed-pak -- wish you'd ship a couple of those new type bits by Thursday for No. 3.
Jamaica
Caracas
C&S
CHICAGO & SOUTHERN AIR LINES
General Offices: Memphis 14, Tennessee
Branch Offices in Principal Oil Centers

Drilling High-Temperature Formations

(Continued from page 101)

gram to the depth where the mud density must be increased to a high value, then replace the entire mud system (which probably contains a large quantity of light solids) with a system of the composition shown in Table 1. The order of addition should be as indicated in this table.

It should be noted that replacement of the mud system at a moderately low density will avoid discarding the large quantity of weighting material which would be necessary should the replacement be postponed until the mud density becomes substantially higher.

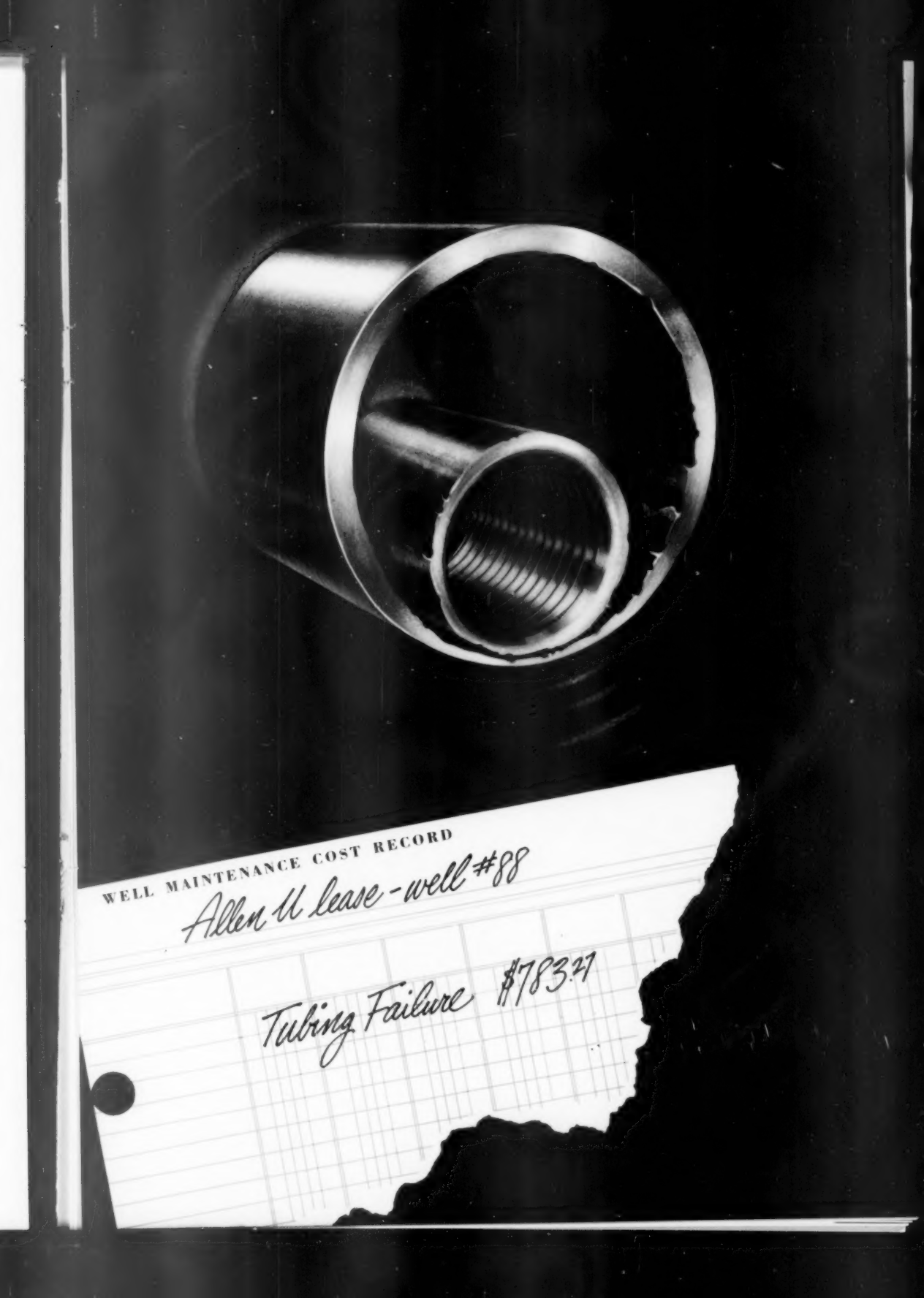
Maintenance requirements of this mud system will vary with the drilling rate and the type of formation drilled. Its control will be more sensitive than conventional lime-base systems where large excesses of lime and caustic soda are carried. Generally speaking, periodic treatment of small amounts of lime necessary to maintain the pH from 10.5 to 12.0 will be the primary maintenance. It is important that this and all other additions should be made in the length of time necessary for one complete mud circulation to avoid "spots" in the mud system. On some occasions the mud may appear to thicken slightly upon lime addition. However, when proper quantities of dispersants are present in the system, this difficulty is usually alleviated after circulation through the hole.

Caustic soda should be added only with quebracho or lignitic material and in the ratio of 5 to 1, treating agent to caustic soda. It is preferable for the caustic soda and the treating agents to be mixed thoroughly in a chemical barrel and then added to the mud ditch.

The physical properties of the drilling-fluid system will vary slightly, depending on the water-loss value desired. However, following are listed typical properties of a lime-treated, 18-lb. per gal. (135 lb. per cu. ft.), mud system. These data were obtained from tests performed on a mud system which was successfully used in drilling and completion operations in a deep Gulf Coast well where bottom-hole temperatures were approximately 325° F.

A.P.I. 30-in. water loss, cc.	4.5
Plastic viscosity, cp.	35.0
Yield value, lb. per 100 sq. ft.	3.5
Stormer viscosity, cp.	80.0
Marsh-funnel viscosity, seconds	55.0
Initial gel strength, g.	1.0
10-minute gel strength, g.	5.0
Mud density, lb. per gal.	18.0
Mud density, lb. per cu. ft.	135.0
pH	11.5

It should be pointed out that the water loss of this mud system at 325°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F. compared favorably with that of a conventional lime-base mud, using starch as the water-loss-reducing agent, which had a 1.0-cc. water-loss at 80 F.

Treatment to control viscosity . . . Viscosity increases may occur when the pH is allowed to drop to approximately 10 or below. In most cases this difficulty can be corrected by lime addition.

Treatment to control water loss . . . Undesirably high water loss can be corrected by one of two methods. Addition of lignitic material to the emulsion-type system will usually reduce the water-loss by improving the degree of emulsification. Also, CMC, polyacrylonitrile, or other relatively temperature-stable organic colloids can be added to reduce the water loss.

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Job-Progress Reporting

(Continued from page 105)

cussed previously are really basic tools used to permit effective conduct of a job. However, in most companies, management desires to keep informed on over-all job progress and from a practical point of view it is not desirable to transmit four or more detail documents on each job. Accordingly a simple report that tells the complete story at a glance is usually received with more favor.

For this purpose the "Job Schedule Progress Report" is offered. This is a graphic representation of scheduled activity and actual job progress on a percentage basis. The data for preparation of this report is of course obtained from analysis of the master schedule and from monthly reports on various activities described previously. It is believed that the form is self-explanatory, bearing in mind that the upper portion of each line represents the scheduled performance and the lower solid half, actual progress. The "Purchasing" and "Shipments" figures are on a dollar-value basis whereas the others report physical percentages completed.

At the bottom of the form under "Schedule Activity" the same data are presented in another fashion better to show the relationship of the various phases.

THE WISE CONTRACTOR is prepared for emergencies. The River Construction Company, laying pipe across the Trinity River, faced an emergency when a speeder LS 85 dragline slipped into 58 feet of water. This equipment was valuable and urgently needed on the job. The problem was to get it out and get it quickly. Let Mr. B. C. Hall, spread superintendent, tell how he rescued this heavy piece of machinery: "The only solution was to hook up two cables from two Carco winches and lift the speeder out. Those two Carco winches brought out that 44-ton dragline like it was a pail of water from a well. On pipeline work, the Carco winch can't be beat for efficiency, pulling power and long life."

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REPORT TO
REFINERS .

Petrochemicals Unlimited

by Gustav Egloff*

"Even though the number of opportunities open at present is enormous, new ones are continually appearing to assure more rapid expansion of the great petrochemical industry."

THE rapidly expanding petrochemical industry is offering an increasing number of opportunities to refiners. This vast industry, which quadrupled its output between 1940 and 1950, is now valued at over 2 billion dollars and certificates have been issued to add to this investment by at least $717,000,000 before 1955. At present, petrochemicals account for 25 per cent of our total chemical production and are expected to be supplying about 50 per cent in less than 10 years.

The prediction of an unlimited future in petrochemicals will not seem unduly optimistic when the reasons behind it are considered. Our requirements for these products are now so great that they can no longer be met from sources which were formerly the sole suppliers. In contrast, present requirements are being met through use of less than 1 per cent of our total petroleum production and less than 5 per cent of our natural gas. Furthermore, the maximum requirements projected for 25 years hence can be met without utilizing more than 3 to 4 per cent of the anticipated oil and gas production.

Many of the petrochemicals are the basis for substances which replace scarce or dwindling supplies of such materials as metals. The possibilities for replacement have barely been touched and many new markets are sure to open in this field.

The outlook for the petrochemicals industry will become more apparent through examination of present and potential end products. Except for ammonia which is the largest-volume single petrochemical, the greatest markets lie in that group of compounds used for plastics, synthetic rubber, and synthetic fibers.

*Author is director of research, Universal Oil Products Co., Des Plaines, Ill. Paper presented at annual meeting of Western Petroleum Refiners Association, San Antonio, March 24-26, 1953.

Plastics

The 1955 expansion goal for plastics has been set by the Defense Production Authority at 4.6 billion pounds, which is about twice present output. Predictions for the future, however, have been set as high as 25 billion pounds in 1975 by some authorities. The principal uses of plastics are as replacements for scarce metals, glass, ceramics, wood, natural fibers, leather, paper, and coating materials.

Types . . . Principal types of plastics from petroleum are the phenolics, the alkyds based on either phthalic or maleic anhydride, polystyrenes, vinyls, polyethylenes, ureas, and melamines. Each has a variety of applications with some ranging from large molded parts to adhesives.

One of the most promising markets is in large molded parts. The principal outlets for these are in one-piece molded parts for such items as television cabinets. Phenolics are the most widely used material for this purpose, but ureas and melamines also have many applications in the molding field. The use of phenolic shell molds in foundries, to improve the time-honored sand molds, is another rapidly growing market. The new shell molds produce castings with smoother, more accurate dimensions and require less machining than those from conventional molds. Requirements for this purpose were less than 3 million pounds last year but some experts have predicted rapid expansion of this use until it attains the 200-million-pound per year level.

Pipe lines . . . Another highly interesting new market for plastics is in pipe lines. The 1962 output for this purpose is forecast at 75 million pounds in contrast to present production at slightly over 5 million pounds per year. This use encompasses a variety of types, each somewhat specific in its application. These include sprayed pipe-line coatings such as phenol-formaldehyde, and vinyl - vinylidenes particularly for piping corrosive materials.

The types used as unsupported pipe include polyethylene, polystyrene, styrene-butadiene or styrene-acrylonitrile, polyvinyl chloride, cellulose acetate butyrate and reinforced glass fibers. Typical uses for polyethylene are in carrying water where flexibility, light weight, ease of coupling, and resistance to deposits from lime are desirable characteristics.

Styrene and styrene-butadiene polymers are particularly good for carrying corrosive chemicals such as chlorine and for use through highly acid or alkaline soils. The styrene-acrylonitrile pipe is used for carrying petroleum and because of its high impact strength, in applications where the pipe is subjected to vibration and rough handling. Cellulose acetate butyrate is also particularly useful in the oil industry because it prevents accumulation of paraffins and is particularly resistant to salt water and corrosive soil conditions.

With glass fibers . . . The use of polyester plastics and others in connection with glass fibers results in a number of novel products. The most striking of these is the polyester-laminated glass-fiber auto body which will be in large-scale production by at least one manufacturer during 1953. These bodies will not dent nor rust. They are strong but light in weight and therefore save gasoline and cut down on tire wear. Similar materials have many other applications. One of the most promising is in light-weight bath tubs. The immediate market for this type of tub is for use

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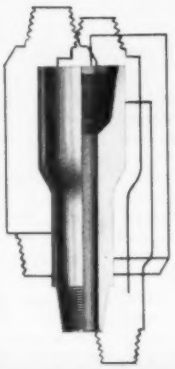

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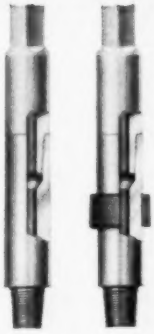

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"The vast markets . . . in agriculture are small compared to those which are forthcoming."

in trailers where weight is so important. The polyester-glass fiber tub weighs about 15 lb. compared to 150 lb. for enameled steel and 300 lb. for enameled cast-iron tubs.

In the household field, vinyl floor and wall coverings and plastic-based paints are representative of the advantages of new products to consumers. Vinyl floor coverings will outlast the best of linoleums and have the additional advantages of requiring no waxing nor scrubbing and of not being stained or decomposed by grease. The synthetic latex-based paints are rapidly replacing vegetable-oil-based paints for interiors. Produced at a rate of about 2 million gallons per year in 1949, they had grown to 40 million gallons in 1952. They have a number of superior characteristics such as ease of application, no odor, and quick drying.

Foam-type plastics . . . Of growing importance are the foam-type plastics. These comprise a number of chemical types including polystyrene, phenolics, vinyls, isocyanates, cellulose acetates, and polyurethanes. These materials are characterized by great structural strength and exceedingly light weight. The polystyrenes have been used particularly for low-temperature insulation and for display pieces. They are now being recommended for use in masonry construction as the cores in concrete blocks.

The phenolic foams are used in thermal insulation, packaging material, and flotation equipment. The vinyl foams more closely resemble foam rubber than do other types. One of the most recent developments is the isocyanate-alkyd foam which can be poured or sucked into spaces in aircraft parts to provide light-weight structural reinforcement. It adheres to wood, metals, fabrics, and glass fibers.

Synthetic Rubbers

The synthetic rubbers represent one of the largest markets for petrochemicals. About 2.5 billion pounds of hydrocarbon raw materials are used annually in synthetic rubber at present and this amount is expected to increase by at least one-third in 10 years. Chemical requirements for the G.R.-S. rubber, the principal type, are about 80 per cent butadiene and 20 per cent styrene. Specialty rubbers also require large amounts of butadiene as well as isobutylene, acrylonitrile, and other chemicals. Because of the great improvements made in both processes and products, synthetic-rubber consumption can be expected to grow steadily.

Petroleum is a supplier not only of the chemical constituents but of processing chemicals, oil extenders, and carbon black. The production of superabrasion furnace blacks was one of the outstanding developments during 1952. Some of these blacks have been shown to decrease road wear of tire treads by as much as 40 per cent.

Fibers

Textile fibers represent one of the largest markets for petrochemicals. Although the new noncellulosic synthetics are important outlets, petrochemicals are used in many processing and finishing operations in connection with natural fibers and rayon. They furnish the acetate portion of the molecule in acetate rayon and some of the sulfur used in carbon disulfide for viscose rayon. They are also sources of many of the processing and finishing chemicals for the new fibers. The manufacture of pyridine derivatives from petrochemicals is a development of specific importance in the new synthetic-fabric industry.

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"There is a place for every refiner, depending on . . . operations, location, other factors."

There are already strong indications of the trend toward greater utilization of the new synthetic fibers. Last year's consumption of these fibers increased 24 per cent to 260,000,000 million pounds while rayon declined 7 per cent. The per capita consumption of all fibers is about 40 lb. a year and is not expected to increase but total volume will grow with population increase.

The static per capita consumption is estimated on the basis of increasing use of the nonrayon synthetics. They wear longer and are lighter in weight. Their popularity is also sure to increase because they require less care. Once the manufacturer has adapted his equipment to utilize them, he is in a better position to produce standardized products. They are made according to specifications and do not vary with the quality of agricultural crops or health of animals as do natural fibers. They are finding widespread use not only in clothing but in other applications such as rugs which can be washed with soap and water and outwear wool many times.

Another example is nylon tire cords which are averaging over 60,000 miles in heavy-duty wear. These fibers also have special applications for which natural fibers cannot be used. The most dramatic of these is the armored nylon vest which has been credited with reducing chest and abdominal wounds by 60 per cent in the Korean war.

The fibers which are or will be in large scale production in the near future are nylon, dacron, dynel, orlon, acrilan and saran. The principal petrochemicals required are benzene, acrylonitrile, butadiene, cyclohexane, p-xylene, ethylene glycol and vinyl and vinylidene chlorides. Plans have now been made so that total production in 1957 will reach 580 million pounds per year. There is, however, high probability that even further expansion will take place as announcements of new fibers or additional plants are frequently made.

Synthetic Detergents

The synthetic-detergent market is another petrochemical consumer which is growing rapidly. Production of these materials increased 21.9 per cent last year while soap declined 9.1 per cent. Total production was over 1.5 billion pounds and is expected to rise to 2 billion pounds within 2 years. While the largest part of this production is alkyl aryl sulfonates, which are derivable entirely from refinery materials, petrochemicals are also important in some of the new types of detergents which are increasing in popularity such as the liquid nonionic types based on ethylene oxide.

Agriculture . . . The vast markets which petrochemicals have in agriculture are small compared to those which are forthcoming. Despite the rapidly increasing use of chemical fertilizers, their value is just beginning to be appreciated in some areas. For example, during the past 4 years, a number of farmers in the corn belt area have increased yields by four and five times through intensive use of fertilizers. The petrochemical industry has a large and growing stake in these products as ammonia and sulfur are primary materials for ammonium nitrate, sulfate, and other products as well as ammonia used as such. Present plans are to produce within the next 3 years, 3.4 million tons of ammonia, over 75 per cent of which will be based on hydrogen derived from natural gas.

Petrochemicals are also a major source of such agricultural chemicals as insecticides, weed killers, fungicides, growth-regulators and defoliants. The trend in the pesticide field is toward

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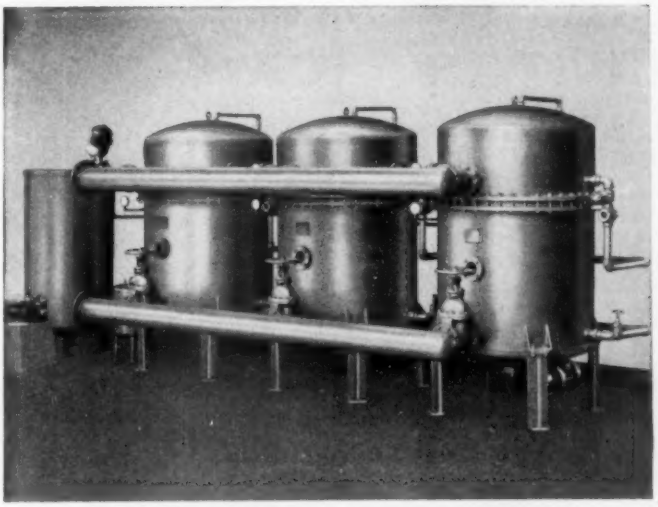

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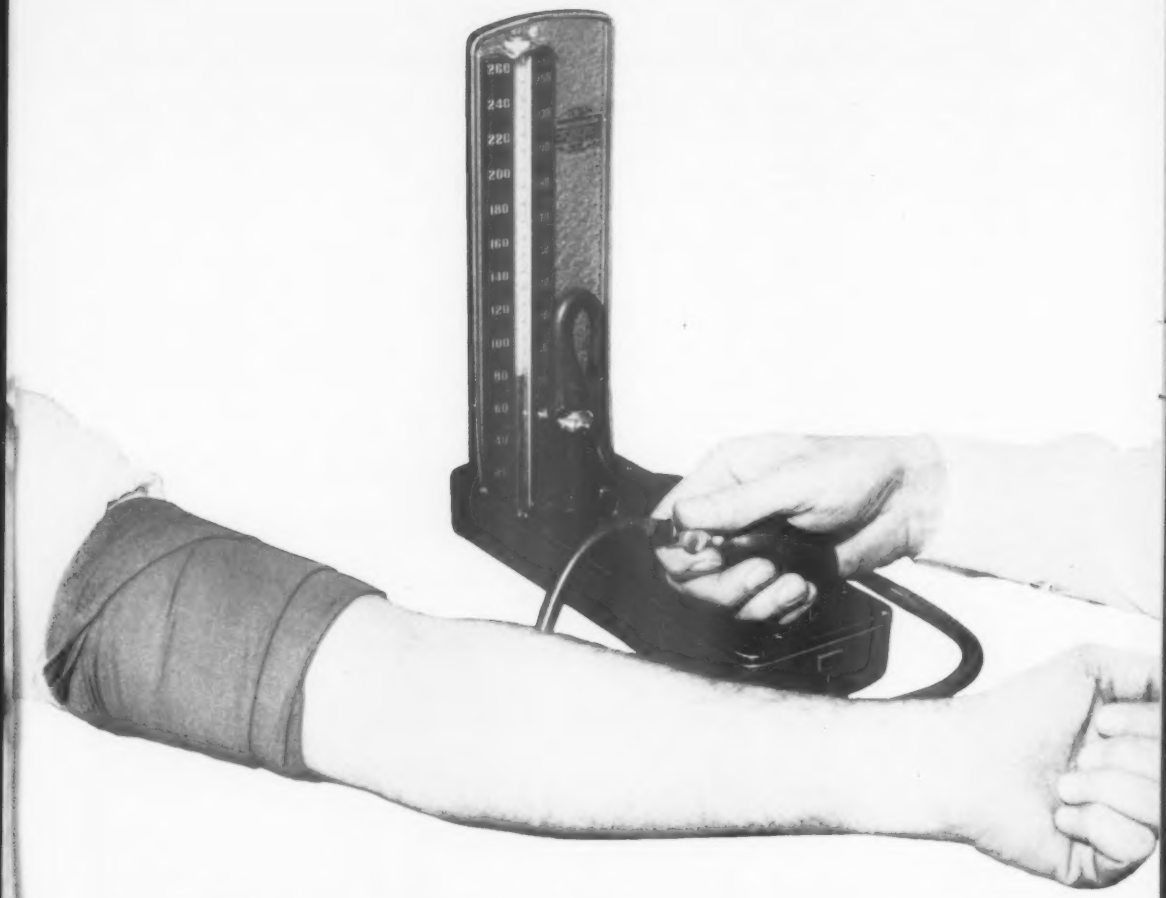

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"There are a number of products suitable for manufacture in all sizes of refineries."

the use of a greater proportion of organic pesticides which are petrochemical rather than inorganics derived from metallic and other sources. The first commercial production of the organic-type insecticides was in 1944. Last year total production of organics was around 300 million pounds per year.

Use of weed killers, defoliants and other chemicals is also more widespread. The significance of petrochemicals in agriculture is well illustrated by the savings obtained through use of the weed killer, 2,4-D. Weeds can be eliminated by the application of 1 lb. of 2,4-D per acre and this operation takes only 1 hour with a tractor-drawn power sprayer as compared to 100 hours of manual weeding. The use of defoliants and other chemicals in cotton farming is also illustrative. It has been estimated that by use of total mechanization and "chemicalization," the man-hours required to produce one bale of cotton could be cut from 155 hours to 10 hours.

Despite the growing use of agricultural chemicals, the present crop losses from insects, fungi, and weeds are startling. Annual losses from insects are estimated at 4 billion dollars per year, from fungi and plant diseases also at 4 billion dollars, and from weeds at 5 billion dollars. This total annual loss of 13 billion dollars provides one of the largest potential markets for petrochemical producers.

The aforementioned fields are only a part of the petrochemical markets. High-tonnage chemicals such as alcohols, acids, and aldehydes used as chemical intermediates, solvents, and in processing represent a large share of the business.

Where Does Refiner Fit?

The question to be answered is where does the refiner fit into the petrochemicals picture. The answer is that there is a place for every refiner depending on the scope of his operations, his location, and other factors. His position may be clarified by analyzing the major basic materials involved.

From natural gas . . . The products of methane are of interest to companies with reserves of natural gas. The highest-tonnage petrochemical, ammonia, is derived therefrom. Its use in agriculture has been discussed, but it also has growing markets in the explosives field, in making hydrogen cyanide for synthetic fibers, urea for plastics and other purposes.

Ammonia . . . An ammonia plant represents a sizable investment. Some ammonia plants have the additional advantage of versatility in that they can be used for production of methanol, the second-largest-volume product from methane. Production of methanol is now being increased by 25 per cent to a total of over 1.5 billion pounds per year. Its principal use is in formaldehyde manufacture. Other important applications include antifreeze and solvents.

Hydrogen cyanide and such chlorinated products as carbon tetrachloride, chloroform, methylene chloride, and methyl chloride are also being produced increasingly from natural gas methane. These products and derivatives of methanol are produced by chemical companies while some oil companies are also producing ammonia and to some extent methanol.

A product from methane of high potential importance is acetylene. Two processes are now in use for its manufacture. There have been a number of problems, particularly in purification of the product, which have stood in the way of rapid expansion. These, however, are being solved and increasing use of methane is expected.

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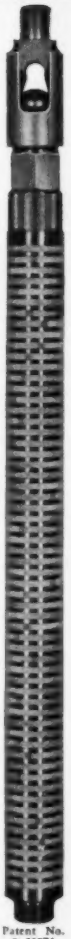

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Ethylene . . . After ammonia, ethylene is the highest tonnage material supplied from petroleum and natural gas. It is not present per se in either source but is produced by cracking of C_2-C_3 fractions of L.P.G., extraction from refinery gases, or cracking of gas oil.

Because ethylene is not readily transportable, it is usually produced very near to the site of its consumption. One large Gulf Coast refiner, however, is installing pipe lines to carry ethylene to a number of consumers, some of whom have plants a hundred miles or more away. There is also difficulty in transporting C_2 gases for manufacturing ethylene and for this reason, propane which can be liquefied and shipped in tank cars has been used extensively. The present trend, however, is toward use of C_2 refinery gases. This source has become increasingly more attractive because of the highly selective separation processes now available. The production of ethylene is one of the greatest opportunities in petrochemicals open to refiners.

The refiner's role in ethylene products need not necessarily stop with the raw material. Auxiliary facilities for some of its secondary products have and are being installed by oil companies of all sizes. The most promising and versatile chemical for this type of operation is ethylene oxide. It is the ethylene derivative in largest demand. Two methods are used for the conversion. One involves a two-step procedure in which chlorhydrin is an intermediate, and the other is direct oxidation. New processes for direct oxidation are available and most of the recently installed units are using direct oxidation processes.

Ethylene oxide is a particularly attractive product because of its many applications. At present, about 75 per cent of the entire production is converted to ethylene glycol. It is also a basic material for acrylonitrile, ethanolamines, and other high-tonnage chemicals.

The acrylonitrile market is one of the fastest growing because of the variety of new synthetic fibers derived therefrom. Consumption will quadruple from a 1952 total of 40 million pounds to 160 million in 1956. The major factor in this rise is a tenfold increase in requirements for fibers. Although acetylene is competitive with ethylene oxide for acrylonitrile, it will be some years before sufficient natural-gas-based acetylene is produced to threaten this market.

Returning to ethylene glycol, it is another product which can be produced to advantage by refiners in connection with ethylene oxide. Major consumption of the glycol is in permanent-type antifreeze and that market is still below the saturation level. It has a variety of chemical markets and new ones develop from time to time. For example, about 1 million gallons per year will be required for production of dacron fiber.

Large as output of ethylene oxide is, it utilizes only about one-third of the total ethylene production. For the most part the manufacture of other major products therefrom is best suited to large-scale chemical companies although a number of the larger oil companies are producing some of these derivatives. The tremendous present requirements and increasingly promising future outlook for these products will be discussed as an indication of the importance of ethylene as a raw material.

Ethyl alcohol . . . The next largest product derived from ethylene after ethylene oxide is ethyl alcohol. Over half of the total alcohol supply is now synthetic and because of anticipated use of increasingly greater quantities of molasses, the other major source, in feed

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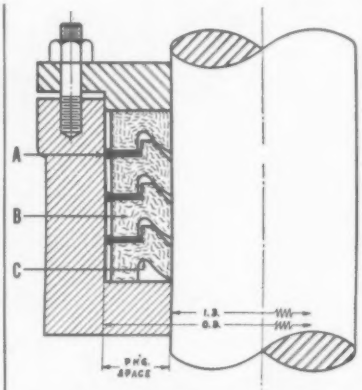

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for livestock, an increase in synthetic production can be expected. The principal use of ethyl alcohol is for acetaldehyde. Large quantities have also been used in butadiene manufacture but when butylene supplies become adequate, alcohol will probably be abandoned as a source. New derivatives are continually being commercialized and thus requirements will be increased. A large chemical company is the principal producer of ethyl alcohol.

Styrene . . . The third largest market for ethylene is in the manufacture of styrene of which four large chemical companies are principal producers. Synthetic rubber is at present utilizing about 50 per cent of the supply and polystyrene 36 per cent. Present expansion of total capacity will increase production by more than 40 per cent to a total of over 1 billion pounds per year. Even though rubber production may not be increased rapidly, there are limitless possibilities for polystyrene plastics. Although already one of the chief plastics materials, new uses continue to be found. There are also large markets in copolymers which serve as the basis of latex paints, in polyester resins used in laminated glass-fiber articles, and others.

Perhaps the most rapidly growing market for ethylene is in polyethylene plastics. Already established as a material for wire insulation, film for packaging, pipe lines, and bottles, it is finding new applications in its low polymer forms as wax substitutes. Production is now at the rate of about 90 million pounds per year but is expected to jump to 300 or 400 million pounds within the next 2 years.

Other large-scale consumers of ethylene are the halogenated products, ethyl chloride, ethylene dichloride, vinyl chloride, and ethylene dibromide. Tetraethyl lead is the principal outlet for ethyl chloride, ethylene dichloride, and dibromide. Vinyl chloride is used principally in plastics. Some oil companies as well as chemical companies are engaged in the manufacture of these derivatives.

Propylene . . . Although one of the large-scale uses of propane is in the manufacture of ethylene, it has other major uses as a source of propylene and for direct oxidation to alcohols, aldehydes, and acids. It is available as liquefied petroleum gas or from refinery gases. Demands for liquefied petroleum gases for chemical manufacture rose 35.2 per cent from 1950 to 1951 and are still increasing despite the trend to utilize hydrocarbons from refinery streams for ethylene and propylene.

As a chemical raw material, propylene is of particular interest to refiners. It can be extracted or manufactured from refinery gases and consumed in a number of operations which can be carried out in refinery facilities. The principal use is in isopropyl alcohol the major outlet for which is acetone. It is also a source of butyraldehyde through the Oxo process, the recent development of which has opened a whole new series of petrochemical operations. These products are made by some of the larger oil and chemical companies.

There are, however, a number of products that are suitable for manufacture in all sizes of refineries. These are propylene polymers for detergents and cumene for phenol. The propylene tetramer is used in the alkylation of benzene for producing alkyl aryl sulfonate detergents, and the trimer is used in alkylating phenols which are used in other types of detergents. For the manufacture of the alkyl aryl sulfonates, the refiner can use a conventional gasoline polymerization unit for producing the tetramer. By subsequent alkylation of benzene which can also be produced in the refinery, dodecyl benzene is formed and this product may then be sulfonated with sulfuric acid from refinery gases or acid sludges. The tetramer, dodecylbenzene, and the

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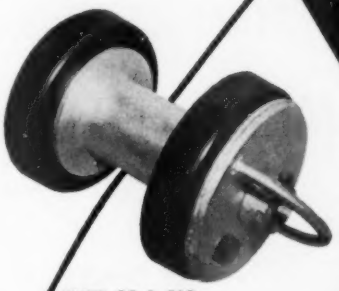

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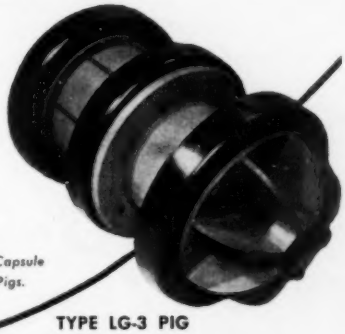

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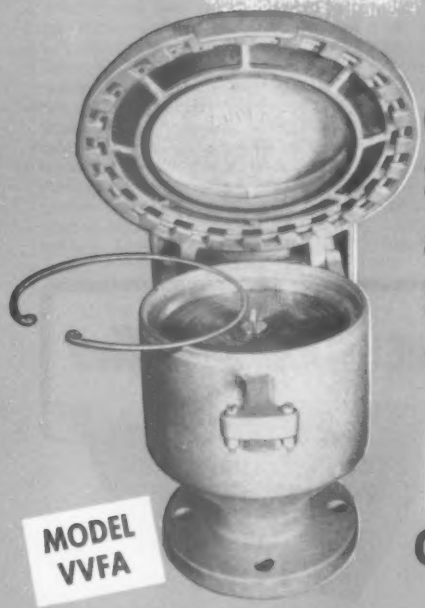

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finished sulfonate are both marketable products. Operations, therefore, can be limited as necessitated by the conditions of a given refinery. Discussion of cumene and phenol production will be given in connection with benzene.

Other Propylene Outlets

Propylene has other major outlets such as propylene glycol. Of particular interest is the range of products now made by the chemical subsidiary of a major oil company in connection with synthetic glycerin, production of which has reached 50 million pounds per year and will probably be expanded by 35 million pounds. The byproducts include allyl derivatives which are chemical intermediates and the soil fumigant D-D. Propylene is also used for some of the acrylic plastics and new uses such as in the manufacture of one of the B vitamins, methionine, are being developed. The future markets for propylene hold great promise and offer many inducements to potential suppliers.

Butylenes are also available from refinery gases, or from the dehydrogenation of butanes in refinery, liquefied petroleum, or natural gases. Although demands for aviation gasoline and synthetic rubber continue to be critical, there are many excellent possibilities for utilization in petrochemicals. Butadiene will continue to increase in demand for many types of plastics as well as for synthetic rubber. Demand for isobutylene for butyl rubber will also increase. Its uses are being extended beyond inner tubes and other present markets. Other important outlets now in existence include polybutenes and secondary butyl alcohol which is in turn converted to methyl ethyl ketone. The polybutenes have many applications as viscosity improvers in lube oils, rubber modifiers, textile lubricants, adhesives, and new uses such as leather impregnation with polyisobutylenes are becoming important. Oil companies are the principal producers of both the alcohol and polymers.

A number of C_5 hydrocarbons also have petrochemical applications. The pentanes are separated for use in amyl chlorides and alcohols which comprise an important class of solvents. Isoprene is an indispensable constituent of butyl rubber. Cyclopentadiene is also being extracted from cracked gasoline fractions for use in making insecticides such as chlordane and aldrin.

The higher hydrocarbons, particularly olefins in the gasoline range, are assuming increasing importance with the development of the Oxo process for manufacture of octyl alcohols. The chief use of these products is in plasticizers. The manufacture of the alco-

hols is being carried out by a number of major oil companies.

There is also a demand for pure cyclohexane particularly for nylon manufacture. About 10 million pounds were used for this purpose in 1952 and it is expected that some of the new plants will use this material. It is being supplied by major oil companies at present.

Aromatics

Perhaps the greatest opportunity for refiners in the petrochemical industry lies in aromatics. Petroleum derivation of the aromatic hydrocarbons began as an emergency measure to fill sudden high demands that could not be supplied through the time-honored source of coke-oven operation. The record of rapid expansion by the petroleum industry to meet these unprecedented requirements has been no less than astounding. During 1950 when the critical shortage of benzene became apparent, its production from petroleum was about 11 million gallons per year. At present it is about 60 million gallons and by 1955, will reach 145 million gallons per year.

B-T-X's . . . About 30 refineries are now either producing or installing facilities for aromatics. Benzene, toluene, and xylenes are produced by the U.O.P. Platforming or other catalytic reforming processes which can also be used for producing high-octane gasoline and thus offer the refiner versatility in the event that demands change. Some refiners are marketing mixed aromatics and others have also incorporated separation units so that they may market the individual hydrocarbons. The Udex and other separation processes are used for this purpose. It may be of interest to those who were present at the W.P.R.A. meeting 4 years ago when the Platforming process was announced, that a total of 52 units have now been contracted for with 20 operating. These include a number of units for aromatics production, some of which are combined with Udex separating facilities.

Although the present rapid expansion is primarily for the purpose of meeting Defense Production Administration goals, future civilian needs indicate that increasing production of aromatics from petroleum will be needed. Benzene is an essential component of styrene, of phenol whether made by the older processes or the new cumene process, of nylon, many detergents, aniline, benzene hexachloride, D.D.T., maleic anhydride, and other important chemicals.

Although toluene is used in largest volumes for T.N.T., it has many other chemical applications and supplies became so scarce in recent months that some benzene facilities had to be utilized for its production. Some of its uses are similar to benzene such as in detergents and in vinyltoluene which serves many of the same purposes as styrene. It is also of interest that toluene of sufficiently high purity for manufacture of saccharin is being produced through Platforming-Udex operations.

The xylenes, formerly marketed entirely as solvents, are becoming increasingly important as basic chemical materials. The first of these to be so utilized was ortho-xylene for phthalic anhydride. The development of dacron has created demands for para-xylene. Recently, commercial production of dimethyl isophthalate for plasticizers, alkyd resins, and polymers has created a market for the meta isomer of xylene. Mixtures of xylenes are being used in this process and thus separation of the meta-xylene is not a problem. The outlook for increasing use of the meta-xylene-derived products is very good as they have been found superior to ortho-xylene derivatives in some applications such as protective coatings and laminated resins. The remaining component of the C_8 aromatic fraction, ethyl benzene, has potential use in styrene production.

Phenol . . . Of greatest interest to refiners in the field of derivatives of the aromatic hydrocarbons is phenol. New processes for production of phenol and acetone simultaneously from cumene have been commercialized. There are a number of stages in these conversions where the refiner may market products. Initially, he produces both benzene and propylene which are the starting materials for cumene. Through use of conventional polymerization units, cumene is synthesized. Cumene can then be marketed or facilities for production of phenol installed. The future of the cumene process is very good because it does not require either chlorine or sulfuric acid which are often in short supply.

Furthermore, the market outlook for phenol is most encouraging. The defense production goal for 1955 has been set at 624 million pounds per year which is about 75 per cent above 1952 production. At present some authorities foresee an even higher demand of 980 million pounds within a few years. This higher estimate is predicated on a number of factors, many of which have only recently become apparent.

The development of new techniques for producing large molded parts and the increasing use of shell molds in foundries will create a demand for 335 million pounds. The use of impact-resistant rubber-phenolic compounds in

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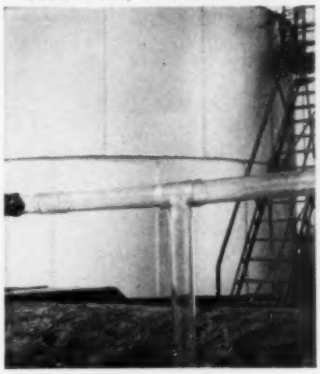

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auto parts, use in waste-wood binder and fiber-glass insulation, and potential use of metallic-coated phenolics for such purposes as auto grilles is expected to build demand for plastics use by an additional 450 million pounds.

Pesticides

Phenol is also a basic material for pesticides such as the weed-killer 2,4-D, and total demand for phenolic agricultural chemicals should reach at least 75 million pounds per year. It also is in demand for petroleum refining and other chemical uses which total 120 million pounds.

In addition to the basic hydrocarbons, their derivatives and ammonia, petroleum refiners furnish fractions for solvents, heavy resins, and carbon-black manufacture. They extract sulfur and naphthenic and cresylic acids as well.

Naphthenic acids are obtained from gas-oil fractions by extraction with dilute aqueous caustic soda followed by acidification. These are converted to metallic salts and used as paint driers, extreme-pressure lubricants, fungicides, engine-oil additives, wood preservatives, and greases, and new uses are being developed. The cresylic acids are phenolic-type compounds recovered from heavy cracked petroleum naphthas, particularly catalytically cracked fractions. Their principal uses are in plastics and plasticizers. Demands for all of these products are good.

Other Products

The production of carbon blacks from oil is of more than passing interest. There is an increasing trend to produce furnace black rather than channel black and to utilize oil rather than natural gas in its production. The oil blacks are of higher quality and less waste occurs in their manufacture. Yields from natural gas are about 10 per cent compared to 40 to 50 per cent from oil.

Sulfur recovery from both natural and refinery gases and from refinery acid sludges accounts for an appreciable portion of new sulfur supplies. Although construction to meet the critical sulfur shortage has been completed, new installations are still being made. Thirty new plants have been completed with total capacity of about 276,000 long tons per year. An additional 422,000 long tons, 21 per cent from natural gas and the remainder from refineries, is projected. While most units are large-scale, smaller recovery plants are becoming increasingly attractive. The long-range supply is such that much of the reserve lies in these smaller increments.

Although the position of refiners in the petrochemical business is largely one of supplying aromatics, low-molecular-weight basic hydrocarbons, nitrogen products, sulfur, solvents, and heavy resin fractions, it cannot be categorically stated that petrochemical operations will be limited by the present size or status of a refinery. New developments, particularly the great advances in such separation processes as adsorption, azeotropic distillation, crystallization, superfractionation, and solvent extraction, are increasing the number of steps which the refiner may take toward the manufacture of end products.

Range of Products

The extent to which oil companies are engaging in petrochemical operations varies widely. A number of the large major companies operate chemical subsidiaries. One company, for example, supplies ortho-xylene-derived phthalic anhydride, is among the largest suppliers of detergents, and also markets naphthenic acids, naphthenate driers, cresylic acids, acetone, aliphatic acids, lube-oil additives, polybutenes and para-xylene. It is now building cumene and phenol plants, the output from which will exceed its own needs.

Another is one of the major suppliers of butadiene and carbon black in ad-

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16% More Power For Your Equipment
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dition to a host of other products and has recently gone into production of pyridine derivatives. Still another is a major supplier of agricultural chemicals in addition to hydrocarbons, oxidized derivatives, glycerin, and other products.

Other companies operate chemical divisions and some have gone into joint ventures with chemical companies. These joint enterprises provide a background of experience in operating chemical plants and marketing chemicals, which is particularly valuable when operations include high investments. The cost factor in plants for such products as styrene, acrylonitrile, and chlorinated polymers has largely limited operation to the major chemical companies. The larger companies in this field all have installations valued in hundreds of millions of dollars. As for end products such as synthetic fibers, the investment is again high, for example, about $30,000,000 for the plant alone to manufacture 30 million pounds of acrilan per year. Other considerations such as experience in fiber production and marketing have brought about joint ventures between chemical manufacturers and textile suppliers.

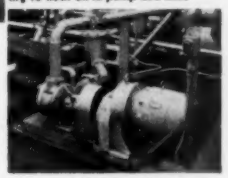
High Investment No Deterrent

The high investment figures, however, should not deter any refiner, regardless of his size, from investigating possibilities. A number of small refiners have found it profitable to manufacture not only raw materials but finished chemicals. It will be desirable in some instances to manufacture products for consumption within the refinery such as sulfuric acid.

The type of operations which will be most profitable varies markedly with each refinery. The factors which must be taken into account are many, and special studies must be made. The location of the refinery in respect to markets for products, the types of transportation required for the products, the type of crude oil or gas which the refiner utilizes, the nature of his present operations, availability of technical men and labor are but a few of the many problems which must be taken under consideration. A decision must also be made as to which will be used when there are competitive processes for making a chemical.

It is suggested, moreover, that refiners now engaged in petrochemical production as well as those who have not done so heretofore weigh the possibilities for future operations. Even though the number of opportunities open at present is enormous, new ones are continually appearing to assure even more rapid expansion of the great petrochemical industry.

Steam is injected through copper tubing to heat oil in pump and line.



Vikings can be operated by remote control or at the tank where it is installed.

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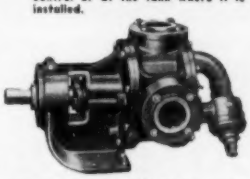
Product handling is reduced to a minimum at Shell Oil Company's Willbridge terminal near Portland, Oregon. Operating 24 hours a day, it uses eleven Viking heavy-duty pumps for blending the different oils needed to meet the season's demands.

If your business needs smooth, economical pumping, investigate Viking pumps. To start, write for complete oil equipment bulletins Series T TODAY.



Heavy-duty, 200 GPM Viking pumps as shown above, are direct connected to geared motors and used in this petroleum handling operation.

VIKING PUMP COMPANY
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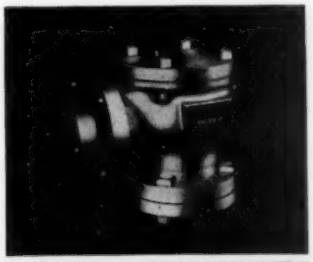
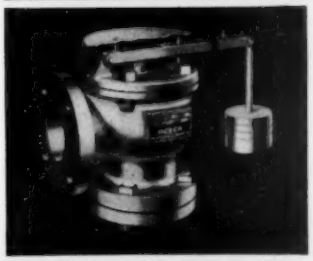
THE ORIGINAL "*GEAR-WITHIN-A-GEAR*" ROTARY PUMP

OCECO
vacuum and *pressure* RELIEF VENTS





● Ideally suited for a wide variety of vacuum and pressure relief requirements. Cast steel housings. Bronze or stainless steel trim. 3" x 3"; 4" x 4"; and 6" x 6" sizes. Standard A.S.A. flanges. Vacuum setting, 1½ oz. to 1 lbs. per square inch. Pressure relief valves provided with a lever and weight for settings from 2 lbs. to 30 lbs. per square inch as desired. Write for fully descriptive data sheet.

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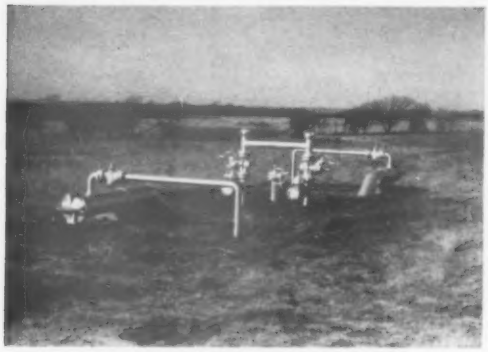
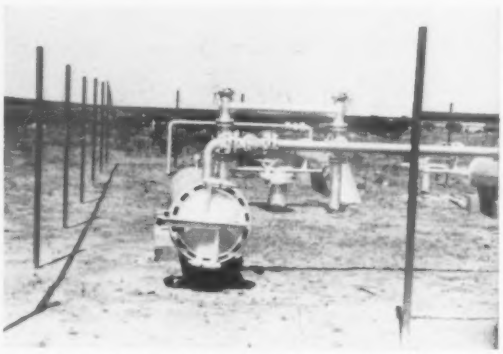


AT MIDWAY STATION, near Marlow, Okla., Oklahoma Natural Gas Co. uses scraper trap on its 16-in. line. Both sending and receiving end are the same, and scraper can be sent in both directions.



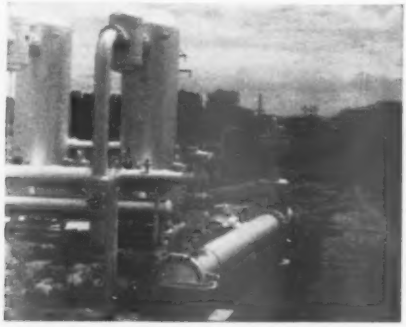
THESE SCRAPER TRAPS are located on Oklahoma Natural Gas Co.'s 26-in. line near Wellston, Okla. The company uses a number of scraper traps on its lines, although "blow jointing" is popular.

Scraper traps for natural-gas lines

SCRAPER traps are still uncommon in natural-gas pipe lining, although they are used extensively in petroleum pipe lining. The "blow-joint method" continues to be the most widely used in gas lines at present.

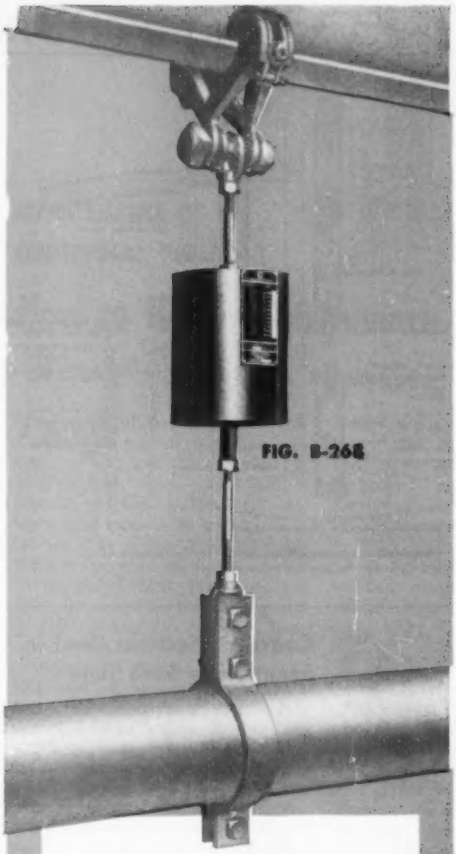
However, these pictures show extensive scraper-trap installations on three companies' gas lines in the Mid-Continent area: Oklahoma Natural Gas Co., Cities Service Gas Co., and Consolidated Gas Co. The installations are used on 10, 16, 20, and 26-in. lines.

These photographs were furnished through the courtesy of Clint Horn, of Thornhill-Craver Co., Inc., Oklahoma City.



LEFT: 10-in. line is fitted with a 12-in. scraper trap at Consolidated Gas Co.'s Marlow, Okla., station. Right: Consolidated installation at Lawton, Okla., showing receiving end of 12-in. scraper barrel for 10-in. line.

TWO VIEWS of Cities Service Gas Co.'s installations near Wichita. Left: 20-in. line with temporary scraper catcher, which is cut into line on temporary basis. Right: Cloud of dirt blown out of line before two plow scrapers and two brush scrapers had been run.



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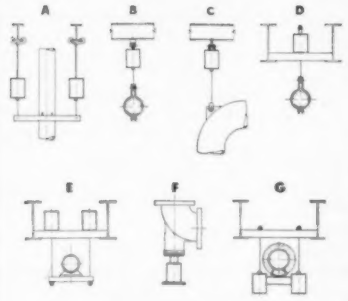
Grinnell Pre-engineered Spring Hangers

- Maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes.
- Precompression* assures operation of spring within its proper working range where variation in supporting force is at a minimum.
- Compact—minimum headroom made possible by precompression*.
- Guides prevent contact of coils with casing wall or hanger rod and assure continuous alignment and concentric loading of spring.
- All-steel welded construction meets pressure piping code.
- 16 sizes available from stock — load range from 74 lbs. to 9000 lbs.
- Easy selection of proper sizes from simple capacity table.
- Installation is simplified by integral load scale and travel indicators.
- Unique swivel coupling provides adjustment and eliminates turnbuckle.

*Precompression is a patented feature.

TYPICAL APPLICATIONS

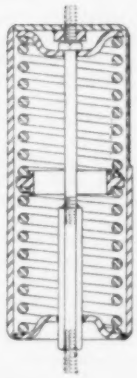


(A) Rod threaded to top cap (B) Furnished with single lug (C) Two lug style (D) Top adjusting (E) Adjustable top and bottom (F) For floor support (G) Trapeze assembly.

FOR LESS VARIATION IN SUPPORTING FORCE — FIG. 98

Fig. 98 is an adaptation of Grinnell's popular spring hanger, Fig. 268. It consists of two springs arranged in series within a single casing. A centering guide insures the permanent alignment of the spring assembly.

Fig. 98 has half the load deflection rate, and double the total working range of Fig. 268. Its 16 spring sizes accommodate loads from 74 lbs. to 9000 lbs. — but with a total working range *up to 5 inches!* Fig. 98 comes in the same seven types as shown for Fig. 268. Design details for identical types and sizes are the same for Fig. 98 and Fig. 268.



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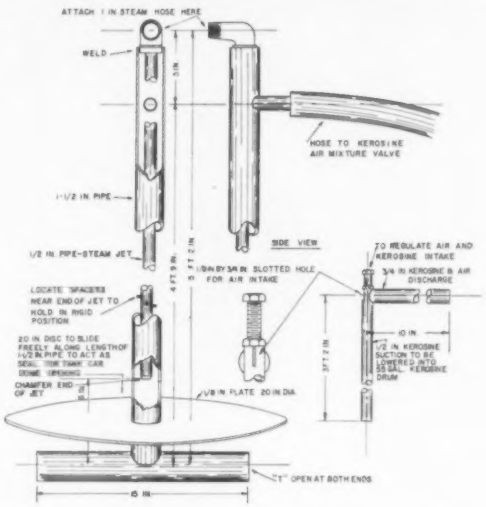
Atomizer Cleans Tank Cars

USE of the atomizer principle has resulted in an effective tool for cleaning tank cars and small tanks. The equipment uses a jet effect to lift kerosine or solvent to a steam nozzle where it is atomized for cleaning interior tank surfaces.

The arrangement cuts the cost of cleaning time and in addition speeds up the cleaning of tank cars which saves time and switching charges when there is a rush in changing stock in cars.


ATTACH 1 IN STEAM HOSE HERE
WELD
HOSE TO KEROSINE AIR MIXTURE VALVE
1-1/2 IN. PIPE
1/2 IN. PIPE-STEAM JET
SIDE VIEW
TO REGULATE AIR AND KEROSINE INTAKE
3/4 IN KEROSINE & AIR DISCHARGE
LOCATE SPACERS NEAR END OF JET TO HOLD IN RIGID POSITION
1/8 IN BY 3/4 IN SLOTTED HOLE FOR AIR INTAKE
20 IN DISC TO SLIDE FREELY ALONG LENGTH OF 1-1/2 IN PIPE TO ACT AS SEAL FOR TANK CAR DOME OPENING
10 IN
1/2 IN KEROSINE SUCTION TO BE LOWERED INTO 55 GAL. KEROSINE DRUM
CHAMFER END OF JET
1/8 IN PLATE 20 IN DIA
"T" OPEN AT BOTH ENDS
15 IN

Fabrication . . . The atomizer consists of two concentric lengths of pipe (see diagrams), the inner one of which is the steam line. Steam enters the inner ½-in. line through a 1-in. reducing elbow.

The outer line is 1½-in. pipe which is connected at right angles to another length of 1½-in. pipe so as to form a "T." This T is used to distribute the atomized mixture against the sides of the tank. The other end of the 1½-in. line is welded to the reducing elbow on the steam line.

Just below the reducing elbow, a nipple is inserted into the 1½-in. line and this connects to the air-kerosine mixture valve by way of a rubber hose.

Steam line . . . The steam line terminates about 6 in. above the T in the 1½-in. line. A sufficient number of spacers are used near the end of the jet to hold it in a rigid position. When steam is turned into the system, the resulting vacuum sucks kerosine and air into the system and the atomized mixture is blown into the tank.

A disk, made from plate steel, slides freely over the 1½-in. pipe and serves as a seal for tank-car-dome openings.

Kerosine line . . . The kerosine-air system consists of a length of ½-in. pipe containing a slotted-hole valve at one end and a ¾-in. line welded perpendicularly at this end. The ½-in. line is lowered into a 55-gal. kerosine or solvent drum through the drum's vent hole. The kerosine discharges through the ¾-in. line which connects to the atomizer via the rubber hose.

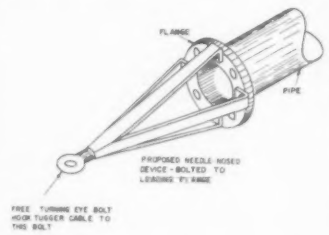
The air intake is regulated by the simple slotted valve in the kerosine line. A ⅛-in. by ¾-in. slotted hole was cut near the top of the ½-in. line. A nut was welded to the end of the line, and a ½-in. bolt, which travels parallel to the slot, has been screwed into the nut and is adjusted so as to regulate the amount of air which may enter the system.

The tool was developed by Sinclair Refining Co., Houston.

Guide for Installing Piping Is Easily Constructed

A guide can be easily constructed for use in moving a pipe into position on overhead supports, which prevents existing installations from hampering its movement.

When a long section of welded piping is being snaked into position on overhead supports, the flange on the end of the pipe tends to hang up on sharp obstructions. To prevent this



from occurring, the pipe may be guided by one or two men. However, such a system is awkward and does not always prevent the pipe from hanging up.

The suggested guide device consists of four heavy steel straps attached to the bolt holes in the end flange (90° apart) and swaged down so that they join together and connect to any eyebolt which is used for attaching the pulling cable. This provides, in effect, a tapered nose on the end of the pipe to prevent the flange from hanging up while it is being snaked along the pipe band.

The method was suggested by Elmo J. Sanchez, welder for Esso Standard Oil Co., Baton Rouge.

Conveyor Sections Used in Semitrailers Save Time

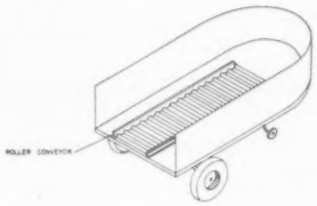
The handling of cumbersome equipment, when loading semitrailers at a storehouse, may be greatly facilitated by use of roller conveyor sections built into the body of the trailers.

A lift truck can simply place the load on the end of the conveyor section and it may then be pushed into any desired position in the trailer.

Previously, small fork-lift trucks would be run into the trailers when loading heavy pieces of equipment. This required a considerable amount of manuevering by the fork-lift operators.

An additional hardship would be experienced when unloading the equipment, which would sometimes have to be dragged off the trailer bed with a steel cable attached to one of the lift trucks. The equipment would occasionally get caught on the trailer floor and either damage it or cause the cable or hook to break.

The method was suggested by Forrest W. Faust, truck driver, for Esso Standard Oil Co., Baton Rouge.



MAINTENANCE OF CENTRIFUGAL PUMPS—3

How to Keep Maintenance Records

by F. B. Applegate*

THE value of maintenance records depends upon how they are made up and how they are used. A card for each pump in the plant is probably the most flexible and most convenient method for keeping such records. The details of every maintenance operation should be entered on the proper card. The cards will show not only what has happened to each pump, but when it happened, the cause, the time required to remedy the trouble, and the cost. The card will also provide the base for forecasting with reasonable accuracy, when, why and for how long a particular pump will be out of service for maintenance. With these data, the plant engineer can schedule shutdowns so that maintenance work can proceed without undue haste and without interrupting production.

Part replacements . . . The frequency of part replacements shown by the card can be used as a guide for either stocking parts or for ordering parts in advance of a failure. A high frequency of parts replacement should be investigated and the cause determined. A change in material may be the solution. Parts may not be properly installed and additional instructions to the maintenance men may be the answer.

Check list-work order . . . A combination maintenance work order and check sheet will be useful, especially when work is done by more than one shift. This sheet itemizes the work to be done, provides space for checking each item as finished or as started but not finished. The items are checked off just before the change in shifts so that the foreman of the following shift can tell at a glance what is to be done to complete the job. When the job is completed, the "check sheet" can be returned to the plant engineer and the data entered on the maintenance record card.

The industrial plant of today, whether it represents an investment of several thousand or several millions of dollars, is furnished with the best of equipment. Because earning power is dependent upon the continuous, economical operation of the plant, neglect of valuable plant equipment is an inexcusable economic loss. It is inexcusable because reliable manufacturers have more technical and practical assistance to offer their customers than ever before. This potential help is available to you in formulating a preventive-maintenance program for your plant.

*Engineer, Pacific Pumps, Inc. Paper presented at N.G.A.A. regional meeting at Midland, Tex., February 27, 1953.

PUMP MAINTENANCE RECORD

Plant Item No. _____ Location _____

Date Installed _____ Service _____

Manufactured by _____ Address _____

Size _____ Type _____ No. Stages _____ Serial No. _____

Rating-G.P.M. _____ Temp. °F. Head Ft. _____ R.P.M. _____ Hydro Test _____ PSI.

Date	Part	Remarks	Cost

A file card such as this is a convenient and flexible method for keeping pump-maintenance records.

BEFORE STARTING CENTRIFUGAL PUMPS, TURBINES, AND MOTORS—

CHECK THIS LIST!

1. Wash and clean exterior of pump and driver.

2. Loosen all flange bolts. Check and correct for pipe strains.

3. Check that all strainers are in position in all suction lines.

4. Check that all cooling water and oil lines are properly connected.

5. Check that all oil sight gages are installed correctly.

6. Check all valves for free opening and closing.

7. Flush and drain all bearings and housings. Refill pumps and turbine housings (not motors) to proper level.

8. Drain steam lines, preheat turbine, start turbine, check rotation and set constant speed governor and overspeed trip (check rotation and r.p.m. if motor driven).

9. Check coupling alignment with driver stopped. Couplings must be within 0.003 in. in radial and axial alignment.

10. Check and clean pump stuffing boxes. Locate position of cooling oil inlet and outlet so that lantern ring may be set correctly.

11. See that pump rolls freely before packing.

12. Check packing and packing gland for type of packing and fitup.

13. Pack and check for proper location of lantern ring. Set each packing ring firmly in place, using the packing compression ring provided.

14. Assemble coupling.

15. Install guard and clean up.

Note: Do not dowel pump or driver.

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by
Ralph F. Nielsen*

History of a Five-Spot Flood—Calculations for a Special Case

IN last week's installment of this series a particular case of secondary recovery by a water flood was presented. In the case described, a water flood was imposed, using a five-spot pattern on a property previously produced by dissolved gas drive until the gas pressure was insignificant. The oil viscosity was assumed low enough so that most of the oil recoverable by the flood would "bank up" ahead of the flood. If the gas pressure was low before the flood, the gas saturation would be essentially zero except ahead of the flood, and the gas ahead of the flood would contribute little resistance to the water injection.

To illustrate the above special case with a calculation, assume a permeability profile such as given in Fig. 1, with no intercommunication between layers of different permeabilities. As is often done in calculations, the streaks are arranged in order of increasing permeability, since the arrangement does not affect the results. Any effect of selective "shooting" is allowed for in the permeability profile. Other numerical values are: Distance from input to producer 200 ft., porosity 15 per cent, oil and water saturations before flood 45 and 30 per cent, oil and water saturations behind front 35 and 65 per cent, water viscosity 1 cp., relative permeability to water behind bank 0.3, effective well radius 1 ft., bottom-hole injection pressure 3,000 psi. It is assumed that the producer is pumped, so that its bottom-hole pressure may be neglected.

*Associate professor, petroleum and natural-gas engineering, Pennsylvania State College.

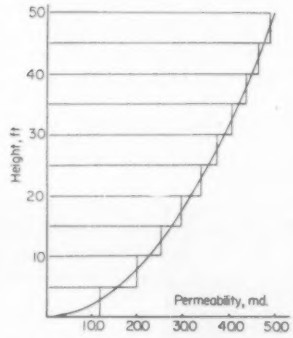


Fig. 1—Permeability distribution profile.

If the resistance of the oil bank is neglected the injection rate per well per foot of sand will at first be given in barrels per day by:

$$\frac{dQ}{dt} = \frac{0.0031 \times 3{,}000 \times 0.3K}{\log R} = \frac{2.79K}{\log R} \quad (1)$$

where R is the radius of water penetration in feet, and K is in millidarcies. R is related to Q by the equations:

$$0.35 \times 0.15 \times \pi R^2 = 5.62Q \quad (2)$$

$$Q = 0.0485R^2$$

$$\frac{dQ}{dt} = 0.097\ R\frac{dR}{dt} \quad (3)$$

Substituting for dQ/dt from Equation 1 and integrating gives (except near the well):

$$R^2\ (0.5 \log R - 0.11) = 28.7\ Kt \quad (4)$$

Equation 4 may be used to estimate the "fillup" time to the point where the banks from the various wells begin to merge, that is R = 120 ft., roughly. This is 467/K. The time required for the rest of the fillup may be estimated by assuming a rate between that at R = 120 ft. and that given by the five-spot formula:

$$\frac{dQ}{dt} = \frac{1.4\,K}{\log 200 - 0.269} \quad (5)$$

for the conditions assumed. For R = 120 in Equation 1 the rate is 1.34K. Equation 5 gives 0.69K, so that the average is 1.0K. The quantity of water necessary to fill the five-spot, so that oil production just begins, is 80,000 × 0.15 × 0.25/5.62 = 535 bbl. The amount injected when R = 120 for the water flood is 0.15 × 0.35 × 120² × π/5.62 = 423 bbl. Thus 112 bbl. is assumed to be injected at a rate of 1.0K, the time required being 112/K. The time to the first oil production is then 579/K. The oil gathered into the bank is 80,000 × 0.15 × 0.10/5.62 = 213 bbl. The time required to produce this at 0.69K bbl. per day is 309/K. Fig. 2 shows the application of these quantities to the profile of Fig. 1, taking 10-ft. layers. The total production is given by the sum of the heights of the rectangles at any time. The summation (integration) is simplified by plotting on a scale linear with respect to height of formation, and then indicating the corresponding time (Fig. 3). Fig. 4 shows the production-time curve.

The assumption made above are, of course, highly hypothetical and oversimplified. Such things as the oil trapped in "dead" areas and the "trailing" production cannot in general be ignored. Like many theoretical approaches this discussion illustrates a method of calculation which is applicable in part in certain special cases.

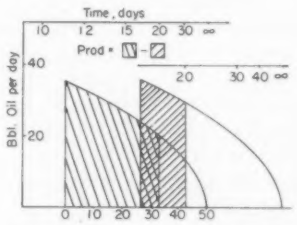


Fig. 3—Calculation method based on smoothed profile.

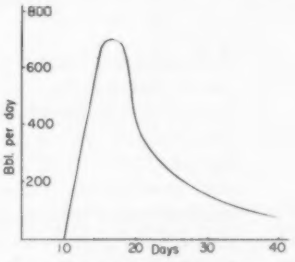


Fig. 4—Calculated production history for five-spot.

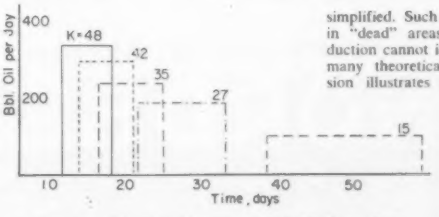
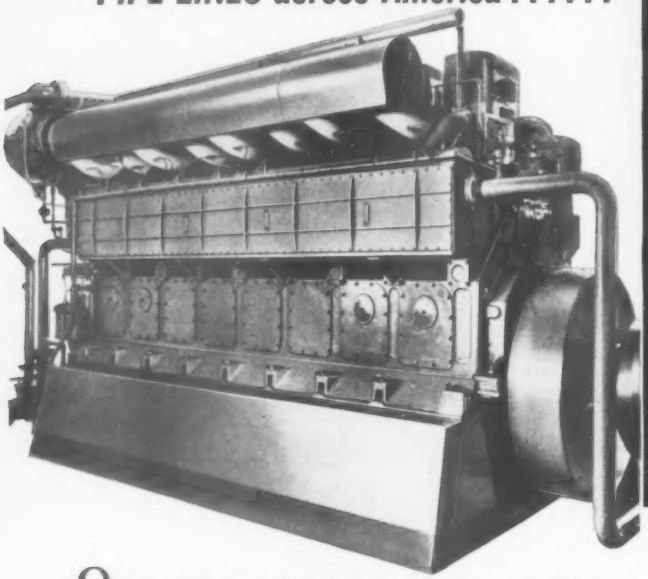


Fig. 2—Production histories of individual streaks.

Reference

Muskat, Physical Principles of Oil Production, McGraw-Hill, 1949.

On the CRUDE OIL and PRODUCTS PIPE LINES across America.....



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O-153

by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Effect of Viscosity of Fuel Oil On Cracking Yields

"In your many articles on cracking, coking, viscosity breaking, etc., you always state the yields as a function of A.P.I. gravities of feed stock and fuel oil. You must know that viscosity of fuel oil, not gravity, is the difficulty that confronts refiners. What is the relation of fuel-oil viscosity to yield?"—F.P.R.

Although viscosity of the fuel oil is the specification that finally keeps a refiner from making larger yields in cracking, viscosity is not the major factor in determining yields. In fact, the reverse is the case during most ranges of cracking intensity. Actually the viscosity of the fuel oil gets lower and lower as cracking is conducted more and more vigorously until finally in the last effort further to increase the yield of gasoline (or gas oil), the viscosity of the fuel oil begins to rise again. In the cracking of gas oils or light reduced crude oils (little asphalt), almost all of the cracking is complete before the viscosity of the fuel oil begins to rise. Thus, for a 34.8° A.P.I. Mid-Continent gas oil:

Per cent gasoline	A.P.I. of feed less A.P.I. of fuel	Viscosity of fuel
31	4.9	84
38	7.7	79
42	9.8	76
46.5	11.3	72
50	13.3	69
53	15.2	63
57	16.8	56
59.5	18.4	63

The same happens to some extent even when cracking 19.7° A. P. I. mixed-base reduced crude oil:

Per cent gasoline	Furol vis. at 122° F. (feed)
None	570
8.8	406
26.0	556
26.8	1,039
40.3	1,665
46.8	14,100

These cracking runs indicate clearly that degradation of the gravity of the residue (fuel oils) is the major factor in determining cracking yields and that viscosity of the fuel oil does not vitally affect the yield until the final stages of cracking. Furthermore, with light feeds which produce little fuel oil, the fuel-oil viscosity does not become important until very large yields are attempted, whereas viscosity is significant from the very first when viscosity breaking asphalt-rich feeds. It is obvious, too, that yields cannot be significantly increased by producing more viscous fuel oils if the feed stock is one that does not contain much fuel oil. Thus, if a feed produces only 15 per cent of 300 Furol viscosity fuel oil, no great increase in the gasoline yield can be expected by producing a more viscous fuel oil.

At our present state of knowledge, about the best that can be done is to compare yields. Table 1 was derived from only four sets of data, but it appears to be consistent even though one of the stocks was a gas oil and both paraffinic and naphthenic stocks are represented. It shows the increase in viscosity that is caused by a decrease in fuel-oil gravity of 1 unit A.P.I. It applies only to the final stages of cracking, that is, after the residue has been degraded to a gravity close to that of the final fuel oil. Thus, when a 25° A.P.I. mixed-base reduced crude oil has been degraded to a 12° A.P.I. fuel oil, it may be found that the fuel-oil viscosity is 250 Furol.

TABLE 1
Approximate Change in Furol Viscosity (@122) of Fuel Oil for a Change of 1 in Fuel-Oil Gravity. For 14°-22° A.P.I. Residual Feed Stocks*

(Note: Use only through short ranges of 2°-4° A.P.I.)

Viscosity range, Furol at 122° F.	Change in viscosity caused by a change of 1 in gravity*
200	110
300	170
500	300
1,000	600
1,500	900
2,000	1,300
3,000	2,000
4,000	2,600
5,000	3,500
6,000	4,500
10,000	8,000

* It might be expected that the viscosity of the fuel would increase twice as fast for a 30° A.P.I. residual feed stock which produces only half as much cracked fuel oil, and that the viscosity would change less rapidly for feed stocks whose gravities are lower than 14° A.P.I.

According to Table 1, a reduction in gravity to 11° A.P.I. will cause the fuel-oil viscosity to rise by about 140 units to 390 Furol. Further reduction in gravity to 10° and finally 3° A.P.I. will cause viscosities to increase somewhat as shown in Table 2. Also shown in Table 2 are the increases in yield that would be expected for this particular 25° A.P.I. stock which is being cracked in such a system that it produces a 250-Furol-viscosity (at 122° F.) fuel oil that has a gravity of 12° A.P.I.

TABLE 2
Illustration of How Fuel-Oil Viscosity Increases with More Vigorous Cracking

A.P.I. cracked fuel	Furol vis. of fuel	Yield, gasoline, per cent*
12	250	47.0
11	390	48.2
10	630	49.5
9	1,010	50.7
8	1,620	52
7	2,640	53
6	4,300	54
5	7,200	55
4	12,100	56
3	21,000	57

*Note that these yields will be decreased somewhat by withdrawal of "cutter" stock for blending with the too-viscous fuels.

Note especially that Table 1 can be used only in estimating the behavior of an already operating unit. The gravity and viscosity of the fuel being produced in the unit is used as a starting point in judging the behavior of the unit other gravities (and viscosities) of fuel oil. Increases in gasoline yield can be determined by the change is fuel oil gravity from the many items that have appeared on this page, particularly "Yields in Noncoking Thermal Cracking," February 25, 1952, page 183.

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HEATING-TUBE FAILURES—6

Failures From Chemical Causes

by J. J. B. Rutherford*

THE major cause of chemical attack on steel at elevated temperatures is oxidation. This is generally represented as a wastage of the metal which can be checked by calipers and can be forecast with reasonable accuracy. There is no defense against regular oxidation except to operate at a lower temperature or to resort to higher-alloy steel—usually higher in chromium content. Heater tubes suffer oxidation at the outer surface from exposure to combustion gases. The inside surface, in the oil or petrochemical industries, is frequently carburized, which might be considered as the opposite from oxidation. Fig. 1 shows the external appearance of Croloy 8 tube, 5 x .500 in., after 40,000 hours heating oil to 1,000° F. at 1,000-psi. pressure, at an average heating rate of 6,700 B.t.u. per hour per square foot. There was heavy coking in this unit and, in combination with high heat input, the metal temperature on occasions must have been quite high. Metallographic evidence established that the side of the tubes illustrated here, had been above 1,500° F., but it is not known for how long. Fig. 2 represents the same surface after shotblasting to remove the scale. The pattern still remains and the cracks in the scale are transposed to the metal to become stress-raising notches.

*Babcock & Wilcox Co., tubular products division. From paper presented at John Zink Process Heating Seminar, Tulsa.

Fig. 1—Heavy scale at thinnest point of wall.

Fig. 2—Same as Fig. 1 after shotblasting.

The rate of scaling may be expected to vary along a length of tube, merely from nonuniformity of temperature. There are other factors[1] which affect rate of oxidation as illustrated in Fig. 3. This is a transverse view through a longitudinal weld in Type 310 (25 per cent chromium—20 per cent nickel) pipe made by rolling and welding plate. The weld covers the outer surface and the crack—actually, lack of penetration — represents the inside surface. The pipe was used in a gas reformer where steam and methane are reacted at 1,450°-1,650° F. This metal composition successfully resisted oxidation at the exposed surface, yet at the frayed surfaces there is pronounced attack. This same phenomenon, where a crack or notch acts to catalyze chemical reactions, has also been noticed to affect carburization. In another instance where a Type 310 tube failed in gas-reforming service, there was observed the peculiar instance, Fig. 4, of the metal being carburized, which destroyed its resistance to oxidation, and then subsequently failing by oxidation.

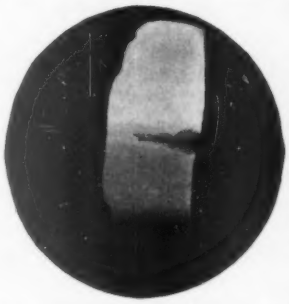

Fig. 3—Pronounced oxidation in unfused portion of weld.

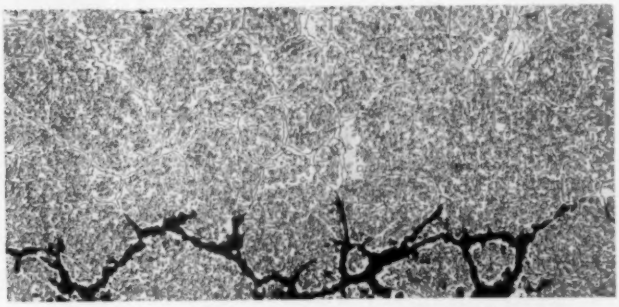

Fig. 4—Carburized zone and intergranular oxidation near tube surface.

Reference

1. Leslie, W. C., and Fontana, M. G.—"Mechanism of Rapid Oxidation . . . High-Strength Alloys . . ." Trans. A.S.M. Vol. 41, 1949.

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KAMLOK Couplings combine *speed, perfect performance, durability*—three features that are indispensable. *Fastest!* Perfectly tight, safe connection *in seconds*, by sliding coupler over adaptor, and pressing cam levers. KAMLOKS couple and uncouple *instantly*, regardless of "hookup." *Efficient!* No wasted time—effort, achieving leakproof-tight connection that guarantees consistently safe operation at peak efficiency. *Long-lasting!* Made of hard wear-resistant bronze to 3". 4" size of OPALUMIN, as strong as bronze, only ⅓ the weight. KAMLOKS add extra life to hose.

Write for Bulletin F-3

OPW CORPORATION
VALVES, FITTINGS, ASSEMBLIES
for handling hazardous liquids
2731 COLERAIN AVE. • CINCINNATI 25, OHIO
DALLAS OFFICE: 2421 Commerce St., Dallas 1 Texas

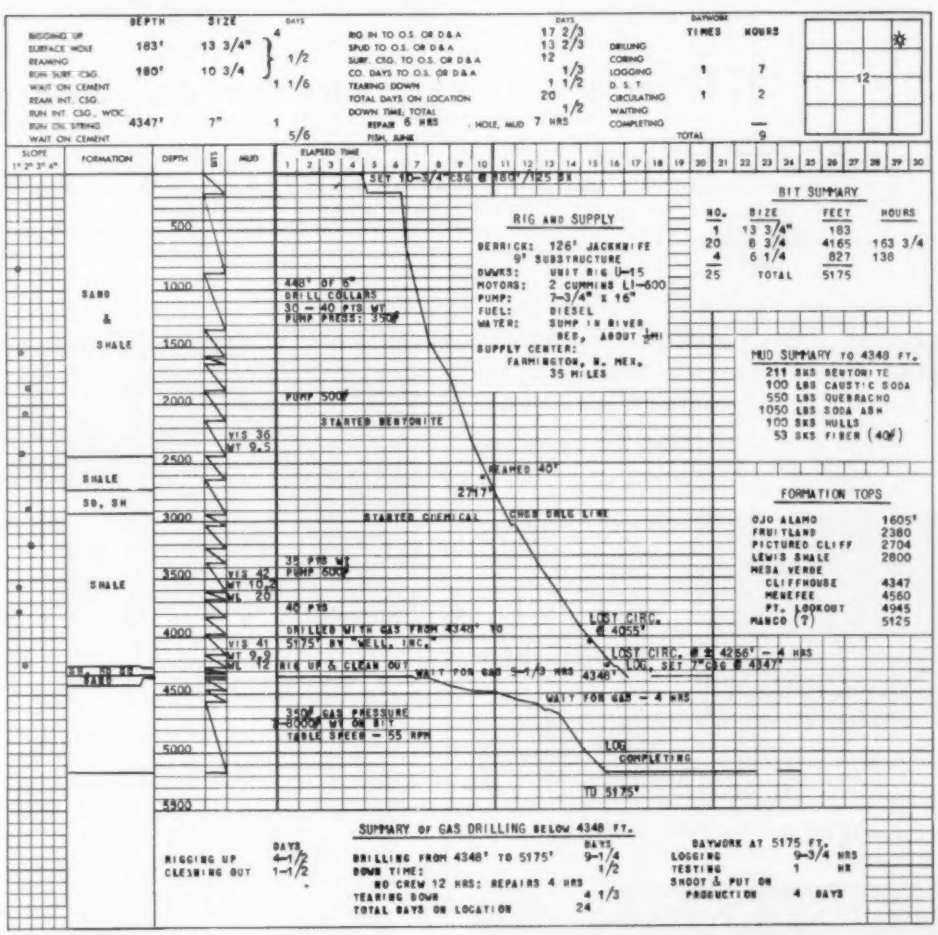
San Juan Basin Drill Log

Contractor: Great Western Drilling Co.

Operator: Anderson-Prichard Oil Corp.

Well: 3 Johnston-Federal

Location: Section 12-30n-9w, San Juan County, New Mexico



(Compiled for The Oil and Gas Journal by Drilling Data Service, Oklahoma City)

For complete specifications write for Bulletin 50.

ACCURATE GAS PRESSURE

The RS Standard Dead Weight Gage facilitates testing gas pressures; rock pressure at wells; static pressure on orifice meters and pipe line pressure in locating leaks. The design of the gage is based on the principle of applying pressure by a known weight to a hydraulic piston of known area; and of the converse effect to measure unknown pressure by balancing its force on a piston of known area with a known weight.

The instrument is calibrated to indicate pressures with a precision of 0.1%.

Complete Line of Scientific Laboratory Equipment
Also Complete line of
CENTRAL SCIENTIFIC SPECIALTIES

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Cenco . . . one dependable source of supply for everything you need in scientific instruments and laboratory supplies. Over 15,000 items . . . 14 branch offices and warehouses.

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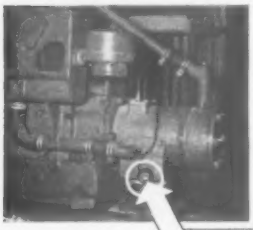
SANTA CLARA LOS ANGELES TORONTO MONTREAL VANCOUVER OTTAWA

NOW FULLY AUTOMATIC SAFETY SWITCH AND THERMOMETER in ONE *Low Cost Unit*

MURPHY Model SD Safety Switch is designed to automatically stop spark ignition engines when temperature rises to predetermined adjustable setting. Prevents "burned-up" engines when fan belt fails or cooling system leaks.



MURPHY SD Model on single cylinder engine. Also adaptable to multi-cylinder engines.

★ VISIBLE, ADJUSTABLE PURE SILVER CONTACTS SHOW OPERATING CONDITION OF ENGINE AND SWITCH

★ BUILT TO WITHSTAND VIBRATION ON CONTINUOUS DUTY ENGINES

★ ACCURACY GUARANTEED AFTER UNLIMITED NUMBER OF ENGINE SHUT-DOWNS

Sold by Engine Dealers and Supply Stores

OIL SHOW TULSA

FRANK W. MURPHY *Manufacturer*
BOX 1476 TULSA, OKLA.
769 N. VINE ST. LOS ANGELES 38, CALIFORNIA

NEW MARSH
Serviceman Soundscope
. . . cuts servicing and maintenance costs

Most effective instrument ever developed for pin-pointing and identifying mechanical defects. Saves time and dollars tracking down troubles in bearings, gears, mechanisms . . . detects leaks, knocks, piston slaps—any defects that make a sound. A precision instrument of Marsh quality, sensitive to faintest sounds . . . with handy probe and headband as illustrated. A remarkable tool, moderately priced.

MARSH INSTRUMENT CO.
Sales affiliate of Jas. P. Marsh Corporation
Dept. L, Skokie, Illinois

Ask for Circular

Part 30 of a series

by Dr. B. E. Lauer, Head, Department of Chemical Engineering, University of Colorado

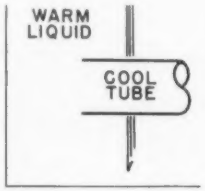
h_f HEAT TRANSFER

COEFFICIENT of HEAT TRANSFER through FILM between OUTSIDE SURFACE of a COOL TUBE and HOT LIQUID

Tube Position: Horizontal

Liquid Movement: Streamline Flow.

Direction of Movement: Normal to tube.



EQUATION:

$$h_f = 0.86 \frac{k}{D_o}\left[\frac{D_o V \rho}{\mu}\right]^{0.43}\left[\frac{c\mu}{k}\right]^{0.3}$$

TERMINOLOGY:

h_f - Film coefficient of heat transfer, BTU/hr. sq. ft. °F.

k - Thermal conductivity of liquid at t_f, BTU/hr. ft. °F./ft.

D_o - Outside diameter of tube, ft.

V - Linear velocity of liquid, ft./hr.

ρ - Density of liquid at t_f, lbs./cu. ft.

μ - Viscosity of liquid at t_f, lbs./hr. ft.

C - Specific heat of liquid at constant pressure, BTU/lb. °F.

t_f - Temperature of liquid film, °F.; $t_f = (t_s + t_b)/2$ where t_s is the surface temperature of the tube and t_b is the temperature of the ambient liquid.

LIMITATIONS:

The Reynolds number ($DV\rho/\mu$) of the flowing liquid must be between .1 and 200. Results are accurate to within ± 15%.

SOURCES OF DATA:

For physical constants for use in above equation see Chemical Engineers' Handbook - J. H. Perry (1948).

for ρ -- see pp. 130-148, 178-195, 1583.
μ -- see pp. 370-374, 1198, 1696.
k -- see pp. 409-461, 1303, 1697.
C -- see pp. 225-235, 297, 1588, 1696.

REFERENCES:

1. A. P. Colburn, Trans. Am. Inst. Chem. Engrs., 29, pp. 174-210 (1933).

2. Heat Transmission, 2nd Edition, W. H. McAdams, p. 228 (1942).

3. Applied Heat Transmission, H. J. Stoever, p. 88.

4. A. H. Davis, Phil. Mag. 47, pp. 972, 1087 (1924).

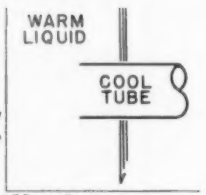
J 2 b (1) (a)

COEFFICIENT of HEAT TRANSFER through FILM between OUTSIDE SURFACE of a COOL TUBE and a WARM LIQUID

Tube Position: Horizontal

Liquid Movement: Streamline Flow

Direction of Movement: Normal to tube.



EQUATION:

$$h_f = \frac{k}{D_o}\left[.35 + .47\left[\frac{D_o V \rho}{\mu}\right]^{0.52}\right]\left[\frac{C\mu}{k}\right]^{0.3}$$

TERMINOLOGY:

h_f - Film coefficient of heat transfer, BTU/hr.sq.ft.°F.

k - Thermal conductivity of liquid at t_f, BTU/hr. ft. °F.

D_o - Outside diameter of tube, ft.

V - Velocity of liquid flowing past tube, ft./hr.

C - Specific heat of liquid at constant pressure, BTU/lb. °F.

μ - Viscosity of liquid at t_f, lbs./hr. ft.

t_f - Temperature of liquid film, °F., $t_f = (t_s + t_b)/2$ where t_s is the surface temperature of the tube and t_b is the temperature of the ambient liquid.

ρ - Density of liquid at t_f, lbs./cu. ft.

USES:

Used to determine film coefficient for forced convection of liquids when the Reynolds number of the flowing liquid is above 200.

LIMITATIONS:

Reynolds number of flowing liquid must be greater than 200 and less than 1000.

SOURCES OF DATA:

For physical constants for use in above equation see Chemical Engineers' Handbook - J. H. Perry (1948).

for ρ -- see pp. 130-148, 178-195, 1583.
μ -- see pp. 370-374, 1198, 1696.
k -- see pp. 409-461, 1303, 1697.
C -- see pp. 225-235, 297, 1588, 1696.

REFERENCES:

1. Heat Transmission, 2nd Edition, W. H. McAdams, pp. 200-227, (1942).

2. Industrial Heat Transfer, Schack, Goldschmidt and Partridge (1933).

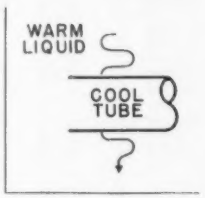
J 2 b (1) (b)

COEFFICIENT of HEAT TRANSFER through FILM between OUTSIDE SURFACE of a COOL TUBE and WARM LIQUID

Tube Position: Horizontal

Liquid Movement: Turbulent

Direction of Flow: Normal to tube.



EQUATION:

$$h_f = 0.38 \frac{k}{D_o}\left[\frac{D_o V \rho}{\mu}\right]^{0.56}\left[\frac{c\mu}{k}\right]^{0.3}$$

TERMINOLOGY:

h_f - Film coefficient of heat transfer, BTU/hr. sq. ft. °F.

k - Thermal conductivity of liquid at t_f, BTU/hr. sq. ft. °F./ft.

ρ - Density of liquid at t_f, lb./cu. ft.

μ - Viscosity of liquid at t_f, lb./ft. hr.

C - Specific heat of liquid, BTU/lb. °F.

t_f - Average temperature of liquid film, °F.

D_o - Outside diameter of tube, ft.

V - Velocity, ft./hr. through minimum free area.

RESTRICTIONS:

No limitations have been set on the Reynolds number except that flow should be turbulent.

SOURCES OF DATA:

For physical constants for use in above equation see Chemical Engineers' Handbook - J. H. Perry (1948).

for ρ -- see pp. 130-148, 178-195, 1583.
μ -- see pp. 370-374, 1198, 1696.
k -- see pp. 409-461, 1303, 1697.
C -- see pp. 225-235, 297, 1588, 1696.

REFERENCES:

1. Introduction to Heat Transfer, Brown and Marco, p. 105.

2. "Refrigerating Data Book", ASRE, p. 88 (1937-1938).

3. Applied Heat Transmission, Herman J. Stoever, p. 88.

J 2 b (1)

EQUIPMENT MEN . . . in the News

Magcobar Names Gulf Coast, Rocky Mountain Promotions

Promotions in the Gulf Coast division of Magnet Cove Barium Corp. were announced recently by George

K. L. BYERLY

E. K. LANE

Moore, general sales manager. K. L. Byerly has been named Texas Gulf Coast division manager; J. Lee Popham has been appointed supervisor of the Abilene, Tex., district; and R. E. Hinchliffe is now district service supervisor at Lake Charles, La.

J. L. POPHAM

R. E. HINCHLIFFE

E. K. Lane has been named assistant manager in charge of Magcobar's new Rocky Mountain area office in Denver.

Byerly was district supervisor in Lake Charles before taking over his present position. He had served as field engineer in Arkansas, Louisiana, Canada, and Kansas since joining Magcobar in 1948. He was previously associated with Cities Service Refining Corp., Mathieson Alkali Corp., and Union Sulphur Co.

Popham has been an engineer in the Texas Gulf Coast division of Magcobar for 2 years. He previously worked for Danciger Oil & Refining Co. at Baton Rouge and Fort Worth.

Hinchliffe has been named to succeed Byerly at Lake Charles. Since he joined Magcobar in 1947, Hinchliffe has served as field engineer and district service supervisor at Houma, La. He was formerly employed by Halliburton Oil Well Cementing Co., and North American Aviation Co.

Lane joined Magcobar as its oil-emulsion representative in 1948. His experience includes a number of years with Shell Oil Co. and Byron Jackson. He organized Oilfield Machine & Supply Co. and served as president until he resigned to join Halliburton Oil Well Cementing Co.

Danielson Appointed Branch Manager for Bailey Meter

Effective January 1, Bailey Meter Co., Cleveland, has announced the appointment of A. L. Danielson as manager of its branch office in Denver. He succeeds G. M. Wallace, who has recently been appointed as assistant sales manager with headquarters in Cleveland.

A. L. DANIELSON

Danielson is a graduate mechanical engineer of University of Illinois. He will supervise the sales and service work of automatic steam plant and process control equipment in Colorado, Wyoming, Utah, New Mexico, and the Texas Panhandle.

Cardinal Chemical Opens Offices at Midland, Tex.

Cardinal Chemical, Inc., has announced the opening of new combined sales and engineering office at Midland, Tex. Services from this point will include all Cardinal products. J. W. Sallee, Ken Ward, and Al Dillard will headquarter at Midland.

J. W. SALLEE

Other Cardinal offices are located at Odessa and Levelland, Tex., and Hobbs, N. M.

Loden to be Honored by Detroit Diesel Engine Div.

R. Loden, sales engineer for Stewart & Stevenson Services, Inc., Houston, is one of 10 men to be honored by Detroit Diesel Engine Division of General Motors for outstanding sales achievements in 1952. As leader in the sale of G.M. diesel engines in a sales zone which includes Oklahoma and Texas, Loden has qualified for the division's annual W. T. Crowe Diamond Award.

Waukesha Sales Holds Annual Sales Meeting

Waukesha Sales & Service, Inc., recently held its annual sales meeting in Houston. Salesmen from Waukesha's branches throughout Texas, Louisiana, and New Mexico who attended included, top row: Louis Peltier; J. B. Krenek; Joe Slay; Joe Wilchek; Kenneth Carlton; J. C. Wolfe; R. B. King; Cecil Hobdy; Zane Toombs; Hal Furry; T. B. Gatewood; Bert Coleman; W. C. Barnes; S. W. Wacey; L. D. Horbour; F. L. Wiley; Leon Miller; Gordon Sies; F. A. Chance; Harold Sherrod. Middle row: James Warnick; L. A. Bell; G. E. Swann; F. M. McCarthy; A. C. Webb; Tom Jenkins; Frank Williams; Coy Shows; Leola Fudge; R. A. Manogue; C. F. Ward; Harry Goss; J. B. Patterson; C. B. Miller; O. E. Bishop; M. D. Russell; Jim Ramsey; Neil Williams; Howard Schaumburg. Bottom row: Bill Ball; D. B. Jeffries; W. J. Buehring; C. O. Zagst; E. R. Rutenber; Harvey Wilson; F. C. Schulze; L. M. Pearce, Sr., chairman of board; L. M. Pearce, Jr., president; L. E. Hodges; W. A. Sahlen; J. L. Kluppel; Earl Gray; and Brant Cox.

Barco Manufacturing Co. Moves to Chicago Suburb

After 45 years in Chicago, F. N. Bard, president, Barco Manufacturing Co., has announced that all of the company's manufacturing and business operations are now being transferred to Barrington, Ill., where Barco has erected a new, ultramodern 103,000-sq. ft. plant.

Barco, a producer of railroad equipment and flexible joints for piping in industry, has broadened its line to include speed recorders for diesel locomotives, portable gasoline soil tampers and gasoline-powered hammers for builders and contractors, and a new line of revolving joints for textile, paper, and other mill equipment.

Jenkins, Iddings Promoted By Lee C. Moore Corp.

Cecil Jenkins has been promoted to chief development engineer by Lee C. Moore Corp., Tulsa. C. D. Iddings,

C. JENKINS

C. D. IDDINGS

formerly chief engineer for Lee C. Moore in Tulsa, is now production manager for the company's Tulsa plant.

Jenkins came to the United States from Great Britain, and in 1930 he joined Lee C. Moore at Pittsburgh where he worked in the engineering department before moving to Tulsa in 1937, where he first served as design engineer.

Iddings is a graduate of Kansas State College in mechanical engineering. He joined Lee C. Moore in 1945 as a design engineer, which position he held until 1950. He was made chief engineer in 1950 and continued in that capacity until his present promotion.

Rumely, Blugerman Elected Crane Co. Vice Presidents

Crane Co., Chicago, has announced the election of V. P. Rumely as senior vice president, manufacturing, and L. N. Blugerman as vice president. Blugerman will have charge of production in the company's plants at Chicago and Chattanooga, reporting to Rumely, who, in addition to supervision of Chicago Works and Chattanooga division, will coordinate manufacturing operations in all plants of the company's subsidiaries.

Rumely, Crane director and vice president, joined the company in March 1937. He was made works manager in 1938 and vice president of manufacturing in 1941.

Blugerman was made executive assistant for Crane Co. in August 1952, after 24 years of engineering production and management experience. He was general manager of Budd Co.'s Red Lion plant prior to joining Crane Co.

C. P. CLARK MacKENDRICK F. W. LAVERTY G. W. PROBST HUTCHCRAFT

F. H. LIGHT E. G. BEARDSLEY R. F. MOSER C. C. HILL

Clark Brothers Co. Announces Key Board Changes

The board of directors of Clark Brothers Co., Olean, N. Y., has announced a number of important changes in membership of its board and corporate officers. C. Paul Clark, former president of Clark Brothers, has been named chairman; John N. MacKendrick has been appointed president succeeding Clark; F. W. Laverty has been appointed executive vice president; and George W. Probst has been named vice president, sales.

David K. Hutchcraft, former vice president in charge of sales, and Frederic H. Light, former vice president, secretary and treasurer, have relinquished their vice presidential responsibilities in line with the company's retirement policies. They will remain with Clark Brothers in a consulting and advisory capacity.

Other important changes include the appointment of Edward G. Beardsley, former chief engineer, as vice president, engineering; Richard F. Moser, former works manager as vice president, manufacturing, and C. C. Hill, former controller of the company, as secretary and treasurer.

Clark has been associated with the organization for 35 years, having joined the company as chief engineer in 1918. Appointed president in 1936, Clark took an active part in engineering and general administrative functions of the company. Clark is also a vice president and director of Dresser Industries, Inc.

MacKendrick came with Clark in 1928 as a design engineer. He was chief engineer from 1936 to 1946, and as vice president in charge of engineering from 1946 until his present appointment.

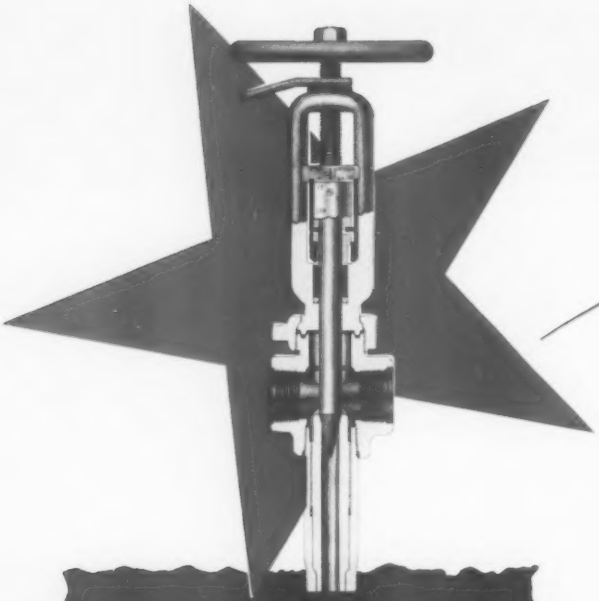
Laverty spent the early part of his 27 years with the company on various production and engineering projects, and later served as manager of technical sales, assistant sales manager, and general sales manager.

Probst has spent most of his 30 years with Clark in the field. In 1942 he was appointed district sales manager of the Tulsa territory and 9 years later was promoted to western regional sales manager. In his new appointment, Probst will make his headquarters at Olean, directing sales activities of all Clark offices.

Watson-Stillman Appoints Diss General Manager

Albert B. Diss has been appointed vice president and general manager, The Watson-Stillman Co., Division of H. K. Porter Co., Inc., Roselle, N. J., it was recently announced by T. M. Evans, president of Porter.

In his new position Diss will be in complete charge of all manufacturing and sales operations. Until promotion to his present position he had been vice president in charge of manufacturing.



★ For working pressures from 1500 to 3000 lbs.

★ All parts interchangeable

★ Bean is quickly and easily replaced

★ Easily converted to positive choke

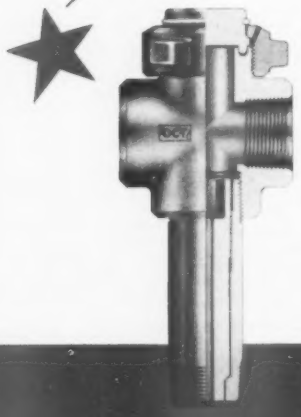
O-C-T THREADED ADJUSTABLE CHOKES GIVE YOU

Four Star Flexibility

The O-C-T Type "N" Adjustable Choke has earned its reputation as the most popular choke in the field by outstanding, dependable performance.

In combination with O-C-T flow tees, this choke can be converted to a positive choke to make proration tests, by backing off the adjustable yoke assembly and inserting the proper size O-C-T FC-140 positive bean or FC-141 insert type cage bean.

Ask your O-C-T representative or write for complete mechanical details on the O-C-T Choke that gives you four star flexibility. Available through your supply store.



Oil Center Tool Co.

P. O. Box 3091 Houston, Texas

Export Representatives: Sterling Areas — Le Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston 1, Texas

O-C-T HAS PIONEERED HIGH PRESSURE CONTROLS

He came to Watson-Stillman in 1950 as manager of manufacturing operations, and in 1952 was elected vice president.

New BJ Service Station Opened at Bottineau, N. D.

John B. Merritt, executive vice president of BJ Service, Inc., has announced the opening of a substation in Bottineau, N. D. This new station offers acidizing and cementing services to operators in the Westhope area. This area was formerly serviced from BJ Service, Inc.'s, Williston, N. D., station. The engineer in charge of operations at Bottineau is J. S. Williams.

Mid-State Names Helvey Kansas Representative

O. C. (Jay) Helvey, of Wichita, Kans., has been appointed sales representative in Kansas for Mid-State Chemical Co., Mt. Vernon, Ill.

Helvey formerly represented a major independent manufacturer of drilling and well-servicing equipment in the Gulf Coast area. He also traveled Oklahoma and Kansas for a major manufacturer, serving all departments of the oil industry.

Mid-State Chemical is manufacturer of oil-field-paraffin solvents, rust-resistant paints, water-flooding chemicals, and gypestone water treat, to prevent corrosion in oil pumping wells.

March Meeting of Houston Nomads Features Travelogue

The March monthly meeting of Houston Chapter of Nomads featured a tiger hunt travelog by world-famous big-game hunter, Jack Roach, Sr., of Houston. This meeting was attended by 93 Nomads and guests. Roach is shown in the center with Don Rushton of Canadian Equipment Supply Co., Edmonton on the left, and M. M. Leitch, London manager of Continental Supply Co., London, England.

Baash-Ross Holds Regional Sales Meet at Oklahoma City

Under the direction of H. (Ink) Wotkyns, vice president and Mid-Continent manager for Baash-Ross Tool Co., and F. L. Tooley, executive vice president of the company, members of the northern Mid-Continent operations of Baash-Ross organization recently met in Oklahoma City for an important regional sales conference. K. S. Ross, export manager for the company, flew in from New York to attend the meeting and gave highlights on his recently completed trip through the principal oil territories of South America. In attendance at the meeting were, front row: R. L. Bowcutt, Casper, Wyo.; M. T. Jimerson and R. L. LeBus, Jr., Oklahoma City; F. L. Tooley, executive vice president, headquartered at Los Angeles; H. C. Siegley, Wichita Falls, Tex., and L. L. Downing, Wichita, Kans. Back row: B. G. Prichard, Duncan, Okla.; P. R. Nagle, Oklahoma City; K. S. Ross, export manager, New York; W. P. Pound, Oklahoma City; W. H. Wallace, Great Bend, Kans.; H. Wotkyns, vice president in charge of northern Mid-Continent operations, Oklahoma City, and H. R. Martin, Casper.

Young is Made Sales Engineer for Eggelhof

H. M. YOUNG

Harper M. Young, Jr., has been appointed sales engineer in charge of Eggelhof Engineers' sales office in Little Rock, Ark., Bob Molnari, vice president of Eggelhof in Houston, has announced.

Before joining Eggelhof, Young was machinist foreman for Delta Shipbuilding Co. in New Orleans for 2 years and sales engineer for Armco Drainage & Metal Products, Inc., in Houston for 3 years.

Young attended University of Colorado and received his mechanical engineering degree from Louisiana Polytechnic Institute in 1949.

C. T. McClure Joins Youngstown Sheet & Tube

Charles T. McClure, formerly with Youngstown Steel Products Co. of California, has joined The Youngstown Sheet & Tube Co. as superintendent of field engineers, tube division. He will work out of the office of J. C. Siegle, general superintendent of the company's tube divsion.

McClure joined Signal Oil & Gas Co. in 1938, and 9 years later he joined Youngstown Steel Products Co. of California, a subsidiary of The Youngstown Sheet & Tube Co., as a field engineer.

Russell Named Assistant Manager, Oil-field Sales

J. C. RUSSELL

J. C. (Bud) Russell, salesman for Republic Supply Co. of California, has been promoted to assistant manager of oil-field sales. The announcement was made by W. Dale Russell, vice president-general sales manager for Republic Supply J. C. Russell will be assistant to Glenn E. Pitts, Republic's manager of oil-field sales.

Russell came to Republic Supply as a warehouse hand and subsequently was moved to the price department, and then the purchasing department in 1943. He served as manager of the Bakersfield and Newhall, Calif., stores, and in 1944 he was promoted to oil-field salesman.

Republic Supply has also announced an addition to the oil-field sales force for the Los Angeles uptown area. C. H. McIntyre, salesman for the Sacramento area, has been transferred to Los Angeles for this purpose. Joe Coffy, refinery salesman, will also serve at this point. George Cadet, who recently returned to Republic from duty in Korea, replaces McIntyre at Sacramento.

The first line of reducers is still the foremost line

TF

Old timers will recall the day—more than 20 years ago—when Taylor Forge announced the first comprehensive line of butt-welding fittings.

Before the WeldELL line was introduced, the only available welding fittings were elbows. But in the WeldELL line came all the fittings needed to do a complete and workmanlike job of pipe welding . . . the tees, reducers, caps, stub ends, and welding flanges.

To produce all of these types of fittings in seamless forged steel was a giant undertaking—and still is. A good example of this is the line of reducers. Today there are 175 reductions in standard weight reducers alone—and this can be multiplied by all the weights and materials in which Taylor Forge reducers are available.

The first line is still the foremost line—the engineered line, the full value line. For up-to-the-minute facts about the WeldELL line, see your Taylor Forge Distributor.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS
General Offices & Works • Chicago 90 • P. O. Box 485
Plants at: Carnegie, Pa., Fontana, Calif., Gary, Ind., Hamilton, Ont., Canada

DIGEST OF NEW EQUIPMENT

IT'S NEW — CHECK IT

TRADE LITERATURE

1 FIN-FAN AIR-COOLED HEAT EXCHANGERS. This 12-page, illustrated bulletin discusses forced-draft-type units designed to cool liquids or gases at pressures up to 5,000 psi. and temperatures as high as 1,500° F. Outstanding design features are described, together with typical application photographs. *The Fluor Corp., Ltd.*

2 LIGHTWEIGHT PETROLEUM TRANSPORT TANK, a multicolored bulletin, describes and illustrates lightweight, stripped, straight-back, and trim-skirted, sloping back, tandem-axle transports, available in standard sizes from 4,000 to 8,000 gal. Tanks are equipped with full-length catwalks 34 in. wide, and featuring triple dished heads. *The Heil Co.*

3 TACO CONDENSATE COOLERS for service as economizer, preheating water, processing, or heating radiation by cooling return condensate, are tested at 312 psi. and have a guaranteed working pressure of 125 psi. *Taco Heaters, Inc.*

4 INSUL-MASTIC TYPE "D" CONDENSATION CONTROL CHARTS is a four-page folder containing specific temperature data and efficiency ranges of Insul-Mastic Type "D" when this insulation is used for controlling condensation. *Insul-Mastic Corp. of America.*

5 SOLUTION TO YOUR PROBLEM OF SCALE AND CORROSION CONTROL. This booklet catalogs 12 glucosates and their specific uses in open and closed cooling-water systems, boiler waters, brines, and air-conditioning equipment. Booklet includes a description of each application. *D. W. Haering & Co.*

6 MODEL 705-B "RUNABOUT" DITCHER is a wheel-mounted unit especially designed for use by utilities and contractors. Folder describes three principal features of the machine; a Chrysler fluid coupling combined with the fully hydraulic "Hydra-Crowd" digging transmission, and the special curved-tooth bucket line. Ditcher is equipped for 15 m.p.h. road speed, and high road clearance. *Barber-Greene Co.*

7 MOTOR AND GENERATOR REFERENCE BOOK is reprinted from the 1952 edition of Lincoln's Industrial-Commercial Electrical Reference published by Electrical Modernization Bureau, Inc. This 50-page book assists in the selection of motive power to handle most industrial applications. Text and illustrations on integral horsepower motors and generators are furnished. *Allis-Chalmers Manufacturing Co.*

8 TYPE A OVERRUNNING CLUTCH FOR HYDROMATIC BRAKES. Bulletin 389 describes this clutch developed to speed up rotary drilling of oil and gas wells and to protect draw works and brake from impact loads. Bulletin illustrates all working parts and principle of operation. *The National Supply Co.*

9 PULSATION DAMPENER FOR SLUSH PUMPS is the subject of a forthcoming bulletin to be published by Hydril Co. Mounted on pump in place of standard air chamber, the function of this dampener is to smooth out pressure peaks in output line. Simple in design and construction, unit is said to add materially to service life of pump, and to reduce maintenance costs. *Hydril Co.*

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Corresponding to new equipment items or trade literature abstracts in the Oil and Gas Equipment Digest of The Oil and Gas Journal, April 13, 1953

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OIL AND GAS EQUIPMENT Digest NEWS CHECK IT

10 LIQUID LEVEL GAGES. Set of new data units, nine sheets, covers complete line of liquid-level gage valves for both tubular and flat gages, regular, offset, and with union connections to gage. Complete specifications with illustrations showing cross-sections, roughing dimensions, standard and optional connections available. *Jerguson Gage & Valve Co.*

11 WATER SIDE DETERIORATION OF DIESEL ENGINE CYLINDER LINERS, an eight-page illustrated article, deals with problems in water cooling of diesel engines, especially a "dynamic" pitting encountered in various services; highway trucks, tractors, and crosscountry gas-line compressor stations. Reasons are given for failure of protective measures to stand up in service and certain steps are outlined that may be expected to provide effective remedies. *The International Nickel Co.*

12 RADIOACTIVITY. New 16-page brochure contains brief descriptions of diverse uses to which radioactivity has been applied, coupled with literature references. A three-page bibliography makes the booklet a valuable and complete reference manual. *Tracerlab, Inc.*

13 FLOW METERS. Set of seven new specification sheets in consolidated style covers electric evenly graduated flow-meter bodies and mechanical evenly graduated flow meters respectively, square-root flow meters and liquid-level meters, and also includes evenly graduated electric flow meters (inductance bridge receivers). Construction and engineering details are included. *Minneapolis-Honeywell Regulator Co.*

14 SERVICES OF A NEW ORGANIZATION specializing in designing, engineering, and building of special equipment, coordinated process controls, and panelboards are described in a new four-page bulletin. Featured in this bulletin are key men of this organization, along with a list of those industries where their services can best be utilized. *Equipment & Controls Engineers, Inc.*

15 MICROMAX MODEL S INDICATING RECORDERS AND CONTROLLERS, a revised 40-page catalog, graphically displays interior views of Micromax instruments, and illustrates and describes sequence of galvanometer detection, typical circuits used, and standard features found in basic Micromax instrument. Specifications of standard instruments for measurement and control are listed. *Leeds & Northrup Co.*

16 RIGHT-ANGLE SOLID-SHAFT GEAR DRIVE. Catalog 26 describes such features as design, lubrication, temperature, and dual drives. Typical solid-shaft installations are presented. *Johnson Gear & Manufacturing Co., Ltd.*

17 STANDARDIZE WITH WESTINGHOUSE HEAVY-DUTY METAL-CLAD SWITCHGEAR. This profusely illustrated 52-page book discusses indoor and outdoor metal-clad switchgears and design features, common to both switchgears. A chart is given showing 14 standard units, equipment furnished with each, and dimensions. Complete specifications and typical installations are included. *Westinghouse Electric Corp.*

18 SPARTAN HOMES TODAY is a colorful brochure which illustrates and describes left and right interior views of Imperial and Royal Spartanette, and Spartan Tandem trailers. Brochure also includes optional floor plans and a section containing 50 questions and answers. *Spartan Aircraft Co.*

19 "CUSHIONED" AUTOMATIC ENGINE STOP VALVE, a new six-page bulletin, features application, fabrication, installation, and design, along with a complete parts list, dimensions for all sizes, and complete specifications. *Golden-Anderson Valve Specialty Co.*

20 CONDENSER TUBE INSERTS used to restore heat-exchange capacity of old condensers with many plugged tubes, are described in Bulletin 500. Inserts are 5 in. long and can be used for services up to 250° F. Special inserts manufactured to meet specific requirements. *Thomas C. Wilson, Inc.*

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DIGEST OF NEW EQUIPMENT

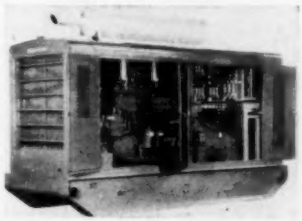
IT'S NEW CHECK IT

by Dan B. Miller

21 HIGHLY MOBILE TRACK-TYPE SHOVEL of 2-yd. capacity is powered by a 66-drawbar-horsepower crawler on a nonoscillating track frame. It is an integral unit with the tractor shovel frame bolted and welded at widely separated points on the tractor-engine support channels and the transmission housing. Rear mounting of the hydraulic system permits better radiator cooling and, along with the high seat position, better visibility. The lift cylinders are horizontally mounted above the tracks to avoid the possibility of clogging with dirt and side-door panels prevent dirt from getting to the engine. The dumping height is 10 ft. 9 in. with a reach of 3 ft. 5 in., insuring dumping of materials in the center of all standard hauling units. The big bucket is made of layer plate to withstand abrasive action. In both the raised-carry and raised-dump positions, the operator has unobstructed visibility both front and rear. Lift arms are of welded box construction for maximum strength and minimum weight. The bucket control arms are made of solid steel and a box-type crossbrace ties the lift arms together. The surge tank and hydraulic control valves are contained in one unit in the rear. Control levers for the bucket and the lift arms may both be operated with one hand. The hydraulic lift-arm control lever, once engaged, remains in position without holding. At the maximum lift, an automatic kickout disengages the lever. Five forward and four reverse gears make the machine adaptable to a wide range of job conditions. *Caterpillar Tractor Co.*

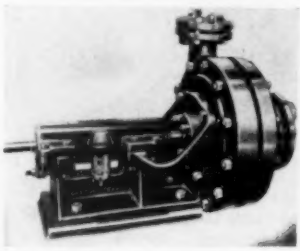
IT'S NEW CHECK IT

22 NEW TYPE HEAVY-DUTY DIESEL-ENGINE GENERATOR is designed to improve the efficiency of large-scale arc-welding operations for steel fabricating work in the field. The 100-kw. unit is built specifically for erectors of large-capacity storage tanks for liquid fuels and water. The generator was developed to overcome limitations of gas-driven welders in this type of application, from the standpoint of operating cost and efficiency. The new unit provides for simultaneous operation of a bank of seven welders, and can also power a 50-hp. electric air compressor plus a drop-cord line for operation of power tools and emergency lighting. Principal advantages it offers include centralization of power source in a single unit for simplified control and maintenance; ability to maintain welding efficiency at great distances, thus assuring a continuous bead and avoiding bubble formation when tack is broken; and portability of the rectifier, which can be easily moved as required during progress of construction. The unit is powered by an International Harvester diesel engine. It is fully equipped with protective controls and devices. Its structural steel base has high ground clearance and a wide skid for maximum mobility and flotation over rough or soft terrain. A weatherproof housing provides complete protection for outdoor operation. *Ready-Power Co.*



IT'S NEW CHECK IT

23 NEW SOLID PLASTIC CENTRIFUGAL PUMP made of a composition containing a phenol formaldehyde resin or furfuryl alcohol resin and an inert filler of absestos or graphite is for handling acids, bases, salts, and many solvents and other chemicals. The pump features a solid plastic concentric casing with solid plastic semiopen impeller. The long heavy bearing housing insures perfect alignment. Specially designed slinger and housing cap with triple internal seals protect the bearings from contamination. The pump is designed especially for mechanical seals, and the fluid end parts are of corrosion resistant solid plastic material. For easy maintenance the bearing housing can be replaced completely without disturbing pedestal alignment or casing. Mechanical seals are easily installed and serviced because of the large drip pan on the pedestal. The pump is



KEEP INFORMED ✓SAVE TIME ✓TEAR OUT CARD ✓CHECK IT ✓MAIL IT

This Digest of New Equipment offers you a quick resume of important features of new or improved products and trade literature and the opportunity to obtain complete information on each subject by use of the convenient "CHECK IT - MAIL IT" service card.

made in 3-in. suction 2-in. discharge size only. Operating at 1,750 r.p.m. the pump will handle capacities up to 300 g.p.m. and heads up to 110 ft. This pump is suitable for operating temperatures up to 265° F. It is not subject to thermal shock even if operated over a wide range of temperatures. *Centrifugal Pump Div., of Mission Manufacturing Co.*

IT'S NEW CHECK IT

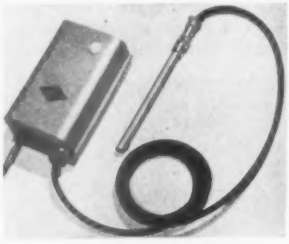
24 NEW PUMPING UNIT MODEL A-40-L. Although this unit is designed for shallow wells, it has an extra-long stroke to provide production in excess of that ordinarily obtainable from units of comparable structural rating. The full length of this stroke is 30-in. but it is adjustable to 26 or 22 in. The samson post, frame, and beam are all-welded steel construction. Structural rating is 4,000 lb. Helical gears are made from forged-steel superflame hardened. Equipped throughout with high-capacity tapered roller bearings, the A-40-L has a double reduction ratio of 33.2 to 1. Torque rating is 17,500 in.-lb. This pumping unit has been extensively field tested and found particularly well suited for many water-flood projects. *Alten Foundry & Machine Works, Inc.*

IT'S NEW CHECK IT

25 NEW THREE-BLADE WALL SCRAPER has an absolute minimum of working parts; has no links or cables to wear, lock, or occasion down-the-hole trouble; and is capable of covering the entire range of oil field scraping operations. It provides full circulation to hole bottom and has no internal bypasses, so that adequate fluid volume at the diamond point or bull nose is assured. The tool is equipped with three rugged, non-clogging, alloy-steel blades, proportioned to give plenty of rigidity during the scraping operation and placed to function with a smoothness and stability that are easy on the rig. The opening of the blades is accomplished hydraulically; the impetus being derived from the mud pumps through a patented circulation control head which creates a downward thrust on the opening plunger and thence completes the process. *Grant Oil Tool Co.*

IT'S NEW CHECK IT

26 ELECTRONIC LIQUID-LEVEL CONTROL. Based on the capacitive action of liquid surrounding a porcelain-enamel-covered electrode this control provides adjustment of liquid level and cut-in, cut-out differential over very wide limits. In operation, the new unit consists of the probe which is mounted directly at the location of the controlled liquids; a connecting cable which can be 1,000 ft. long if necessary; and the control unit which can be located for operating convenience. The two main controls (liquid level and differential) are designed for screwdriver adjustment while a vernier or fine control on liquid level is operated by a panel-front knob. Standard models operate from 115-volt 60-cycle supply while special units are available for 230-volt or 25-cycle operation. The snap-action relay included in the unit is rated for 10 amp. at 115 and 230 volts. An indicator light in the panel front indicates operation of the relay, burning at full brilliance when the relay is open, at half brilliance when the relay is closed. The differential range varies with the type of service but among the applications are liquid level, interface, proportioning, and blending control in petroleum refineries; level control for production, or packaging, or production checking in chemical plants. *Thermo Instruments Co.*

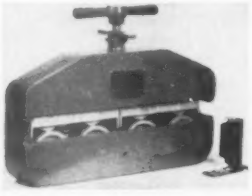


IT'S NEW CHECK IT

27 FYRE-FREEZ. The new portables feature squeeze-type valves and come in five sizes; 2½, 5, 10, 15, and 20-lb. models. These units use Kidde lightweight cylinders and the squeeze-type valve requires only normal hand pressure to actuate the extinguisher after the safety pin has been removed. Recharge is easy, simply squeeze the valve open to permit the recharge gas to enter the cylinder. Carbon dioxide is approved for use on flammable liquid and Class C electrical equipment fires. It performs its fire-killing job by reducing oxygen in the fire area to a degree insufficient to support combustion. Clean and noncorrosive, the inert gas is a nonconductor of electricity and eventually is absorbed into the atmosphere following discharge. *Walter Kidde & Co., Inc.*

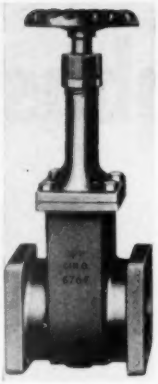
IT'S NEW CHECK IT

28 WELL-MEASURING METER will measure any size line run into or removed from the well by simply changing the trolleys. Trolley change takes about 10 minutes. A single strand of wire, or small cord-cable like a shooter's line will measure the survey cord, which is $\frac{1}{4}$ in. in diameter. It will measure any size cable up to 1 in. with the same degree of accuracy. Weight with case is approximately 44 lb. Size of the steel carrying case is 16 by 20 by 5 in. *The Well Measuring Service.*



IT'S NEW CHECK IT

29 NO. 676-F GATE VALVE has a flanged end body with bolted bonnet of Opalumin, as strong as bronze, and one-third the weight. Interior parts are of precision machined bronze. Ball-and-socket double disks, self-aligning, tapered design seating is against hand-lapped renewable bronze seat rings for a sure vapor-tight, no-leak closure. Renewable seat rings are threaded and seated against shoulder, so despite contraction and expansion of the body, the threaded ring remains seated. Compound double-acting threads allow closer clearance when valve is opened, requiring fewer turns to open and close. Strong, large-diameter stems do not bend. Available in 3-in. size. 676-F valves are ground tighter, engineered with larger stuffing boxes, and machined to closer tolerances, appreciably lessening down-time frequency for valve repair. *OPW Corp.*



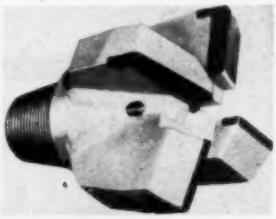
IT'S NEW CHECK IT

30 LARGEST UNITIZED BLOCK AND HOOK. Rated at 400 tons, the Big Shorty has been designed for deepest drilling. It can be initially furnished as a conventional traveling block and then later changed, in the field, into a combination block and hook by the addition of the Shorty Block Hook assembly. Unitized in this manner, the Big Shorty has an over-all length of only 12 ft. 8 in. The weight with hook is 16,700 lb. The Big Shorty features hydraulically cushioned spring-loaded hook, 360° swiveling of hook and link ears, short compact design, heavy-duty bearings, and balanced sheaves. *IDECO a Div. of Dresser Equipment Co.*

IT'S NEW CHECK IT

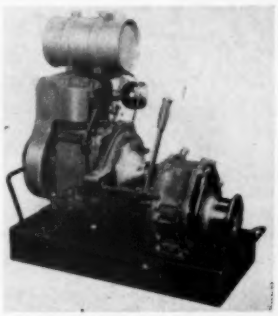
31 DRILLING RIG WORK BENCH is constructed of ⅛-in. plates and 10-gage sheets and is mounted on 4-in. H-beam runners. Six drawers mounted on steel rollers, and two extra compartments, one for oils and greases and the other for rags, are provided. In addition, pegs are fixed to the back of the bench for hanging small hand tools. One lock secures all drawers. Bench is painted with two protective coatings. Three drawers are 6-in. deep and 18 by 24 in. in area. Two small drawers are 6 in. deep, 6 in. wide, and 24 in. long. The large drawer is 6 in. deep, and 24 in. in length and width. The rag bin is 15 in. wide and 24 in. deep. Approximate weight is 1,200 lb. *J & J Steel & Supply Co.*

32 KENNAMETAL CARBIDE INSERTS FOR DRAG BITS provide a wear and shock resistant material for drilling unconsolidated formations and, in some cases, igneous materials. It is particularly popular for bits below 6 in. in diameter for use in slim-hole and core-hole drilling, and on geophysical rigs. An ideal segment design on the regular four-wing drag bit includes 12 to 16 solid Kennametal carbide inserts, both for digging contact on the drag-bit wing and for maintaining ream gage. Kennametal inserted drag bits are usually mounted by recessing the slot and brazing the insert into the bit head through the use of an appropriate flux and brazing material. *Kennametal Inc.*



IT'S NEW CHECK IT

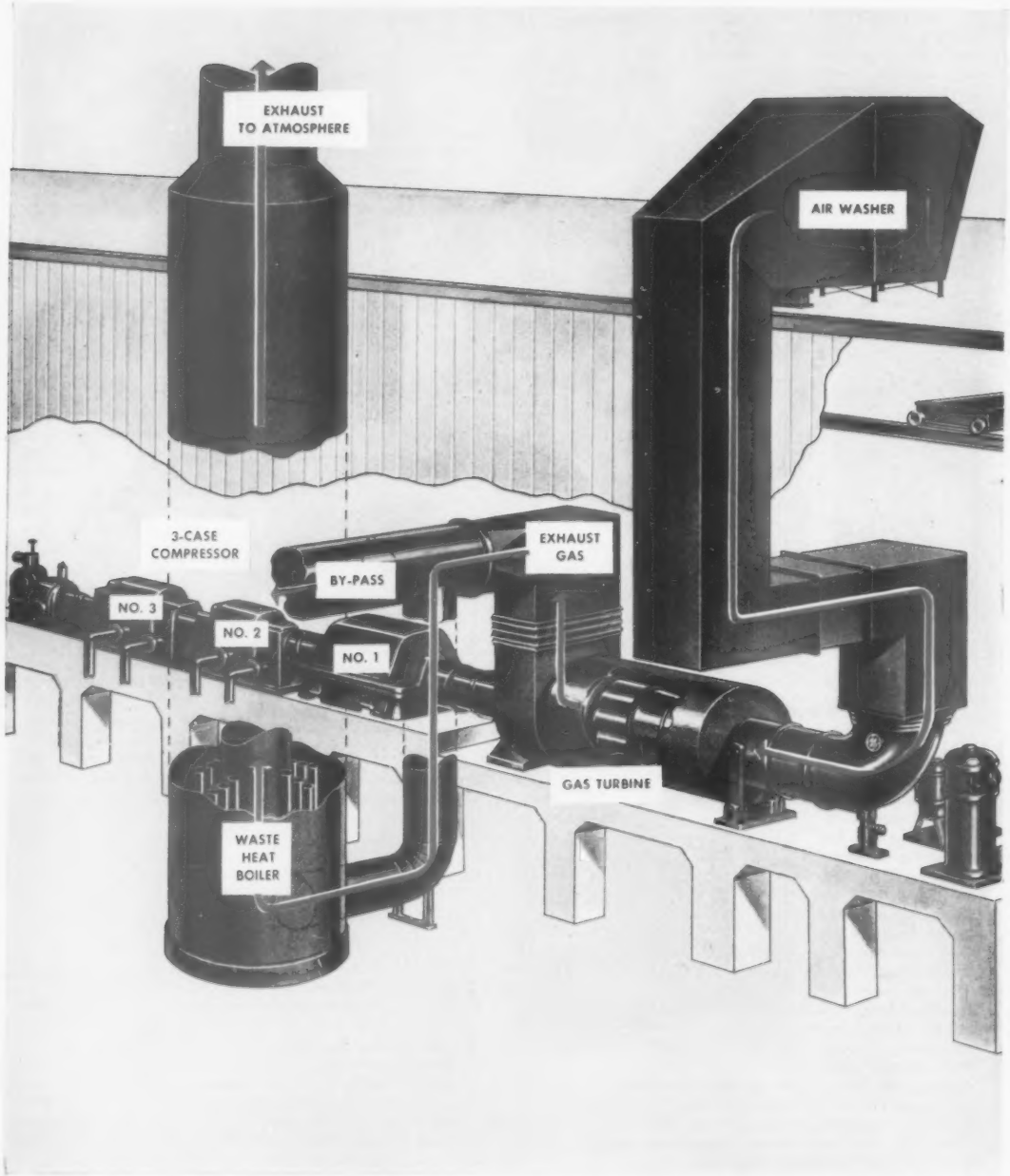
33 STAMPCO GYPSIWINCH. The unit is designed as a multipurpose hoist for fast, low-cost handling of materials in industrial plants, warehouses, and storage yards. Standard models are equipped wth either electric or gasoline-power units ranging in size from ¾ to 7½ hp. Two gripper-type handles facilitate moving the hoist about on the job while the fabricated all-steel base may be secured by lag bolts to provide a stable platform for pulling or lifting. The unit utilises the capstan principle. In operation, the capstan permits accurate spotting of load allowing the operator to skid the line by slacking off pressure while the capstan is rotating. Using this principle, a heavy load may be taken up and stopped very slowly, with no stress on rigging or equipment. A capstan line may be retrieved more speedily than a drum line and eliminates need for level winding. The unit is also available in combination with cable drum, permitting use of either hoisting cable or manila line. *St. Anthony Machine Products Co.*



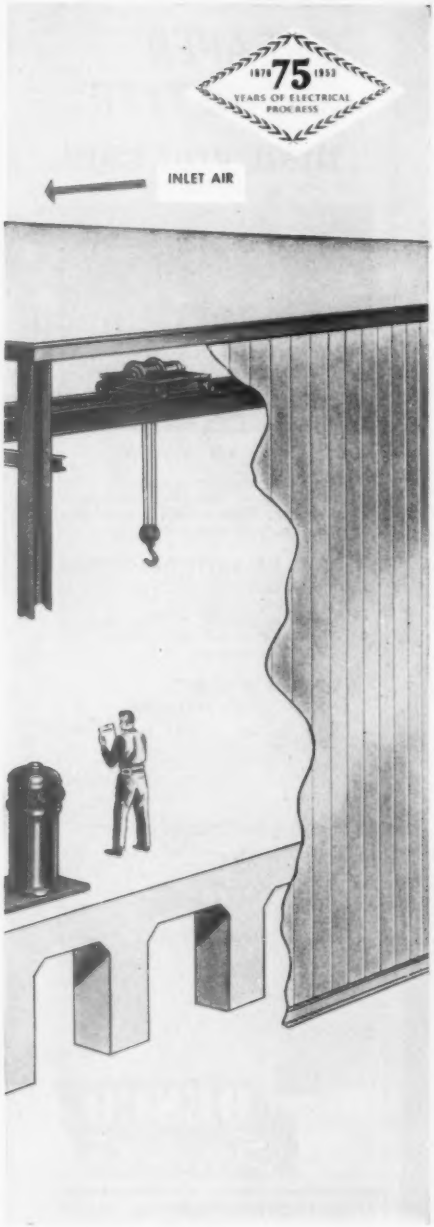
IT'S NEW CHECK IT

34 PENN MAGNA-CLUTCH has the mercury manometer completely sealed as there are no stuffing boxes or pressure tight bearings. The manometer can be inspected and cleaned and the calibration checked without disconnecting the pressure piping. Great flexibility of differential range is provided by seven interchangeable range tubes and continuous range adjustment down to 50 per cent of maximum for each range. It is produced in recording, integrating, pneumatic transmitting, and controlling styles for static pressures to 2,500 psi. *Penn Industrial Instrument Corp.*

Now—G-E combustion gas



turbine for process plants



Reliable prime mover improves heat balance without need for extra steam-plant investment

Here is another application for General Electric's 5000-hp combustion gas turbine—of interest especially to refineries, petrochemical and other process plants that require considerable amounts of low-pressure steam. In many applications, it is the most economical over-all method of driving large centrifugal compressors.

Lower installed cost

If your plant requires more low-pressure steam—for an added new process or the expansion of present processing—you would ordinarily have to build additional steam-boiler facilities to maintain an efficient heat balance. Using the G-E gas turbine and a waste-heat boiler instead, you receive both needed steam and driving power, improve your plant's heat balance, and eliminate the need to invest in an extra steam plant.

Simplified building construction

For the horsepower it makes available, the building to house the G-E gas turbine is small, simple and inexpensively constructed. Foundations cost less because the turbines and the compressors they drive are relatively small and light in weight. Less manpower is required than with other types of drives, for this G-E prime mover is essentially automatic in operation—even lends itself to remote operation. With only two main rotating parts, upkeep costs are low, and maintenance is mostly a matter of periodic inspection.

Backed by G-E turbine leadership

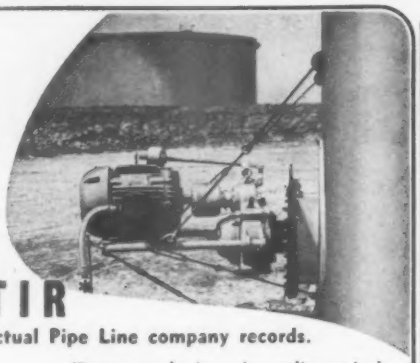
More than 45 years of turbine-engineering leadership stand back of the G-E combustion gas turbine and assure its operating reliability. Your G-E Apparatus Sales representative will gladly discuss its application to your operation. Meanwhile, send for descriptive 16-page bulletin GEA-5530 to General Electric Co., Section 661-39, Schenectady 5, N. Y.

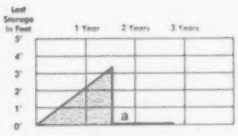
Combustion Gas Turbines for the Petroleum Industry

GENERAL ELECTRIC

MAXIMUM STORAGE FACILITIES MAINTAINED with a SHORTSTIR*

as proven by actual Pipe Line company records.





(a) tank cleaned and SHORTSTIR installed.

These records show that sediment had accumulated, in some cases, at the rate of over 2 feet per year. SEE GRAPH.

These tanks were cleaned and SHORTSTIR Mixers installed.

After one year of service, thiefing revealed less than 1" of sediment.

Installation of SHORTSTIR Mixers—usually at a cost of less than one cleanout—keeps tanks in service and yields appreciable future savings.

*The original SHORTSTER Mixer, designed and manufactured by . . .

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We have built hundreds of these provers in all capacities from 50 gallons to 50 barrels. . . . This experience enables us to deliver a REAL PRECISION INSTRUMENT that is Guaranteed. Building, calibrating and guaranteeing a calibrating tank is specialized, painstaking work and is definitely "out" of the price-per-pound category. These tanks are designed to conform to the A.P.I. tentative code #1101, but may be furnished with such modifications as you, the customer, may require.

WARNER LEWIS COMPANY

BOX 3096 • TULSA, OKLAHOMA

This DESCO mobile unit can lubricate YOUR VALVES *CHEAPER* and *BETTER* than you can!

Records prove that a trained Desco crew and a completely equipped Desco mobile unit can lubricate and adjust all makes of lubricated valves in minutes, when usual methods take hours.

SAVE VALUABLE MAN-HOURS

For example, to lubricate valves by usual methods requires 8½ hours to pump 25 pounds of lubricant—the Desco unit does it in 15 MINUTES! Figure the saving!

ELIMINATE COSTLY HAPHAZARD METHODS

By having DESCO service your valves at proper intervals, with positive lubrication, proper adjustment and the right lubricant, you can expect your valves to last 3 to 5 times longer.

WHO USES DESCO SERVICE?

Anyone who uses lubricated valves can profit by DESCO SERVICE. Refineries, gasoline plants, pipe lines, tank batteries, gathering lines.

MAKE US PROVE IT!

Let us show you how DESCO CAN SAVE YOU MONEY if you are lubricating your valves by usual methods—there's no obligation!

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SHREVEPORT, LOUISIANA, U.S.A.

PIPE LINES

Lakehead Contracts

Eight firms to lay pipe, river crossings for line

SUPERIOR, Wis.—Eight organizations have been awarded contracts for pipe laying and river-crossing construction of the 30-in. extension to be built by Lakehead Pipe Line Co., Inc., between Superior and the international boundary south of Port Huron, Mich.

Lakehead has designated Bechtel Corp., San Francisco, as its agent to coordinate the extension project. The 635-mile line will cost $76,000,000.

Companies to whom basic contracts have been awarded, and the scope of their work is as follows:

. . . **Mahoney Contracting Co.,** Lansing, Mich., 91 miles of line between Superior and the Wisconsin-Michigan line.

. . . **Anderson Brothers Corp.,** Houston, two schedules totaling 190 miles, from the Wisconsin-Michigan line through Crystal Falls to Cooks, Mich.

. . . **Midwestern Constructors, Inc.,** Tulsa, 97 miles between Cooks and a point near St. Ignace on the Straits of Mackinac.

. . . **Bechtel Corp.,** 75 miles from a point near Mackinaw City on the southern shore of the Straits of Mackinac to Red Oak, Mich.

. . . **Conyes Construction Corp.,** San Pablo, Calif., two schedules totaling 171 miles, from Red Oak via Bay City to the international boundary south of Port Huron on the St. Clair River.

. . . **Merritt-Chapman & Scott Corp.,** Cleveland, the 21,000-ft. Straits of Mackinac water crossing. This will consist of two lines, each 20 in. in diameter. Some of the crossing will be laid at a depth of about 230 ft.

. . . **W. J. Meagher & Sons, Inc.,** Bay City, Mich., the 2,500-ft. underwater crossing of the Saginaw River near Bay City.

. . . **Midwestern Constructors, Inc.,** Tulsa, the 2,500-ft. underwater crossing of the St. Clair River at the international boundary south of Port Huron.

Lakehead is a subsidiary of Interprovincial Pipe Line Co., which built the first major crude oil pipe line in Canada. The line extends from a point near Edmonton, Alta., to the U. S.-Canadian border near Gretna, Manitoba.

Michigan permit issued . . . While plans for the Lakehead extension have been

This Line To Take Spraberry Residue Gas

Shown under construction by El Paso Natural Gas Co. is a new 12-in. line to Weiner (Floyd) field, West Texas. The line, to be completed by the first of May, will be able to take an additional 35,000,000 cu. ft. daily of residue gas from nearby gasoline plants. The pipe line is being covered with glass fiber wrapping and enameled before laying.

CLEANER PIPELINES CO.

1900 Armour Rd. No. K. C. 16, Mo.

EFFICIENT cleaning pays off in increased gas volume.

INTERNAL PIPELINE CLEANING EQUIPMENT:

EXPANSIBLE CLEANERS
SPRING LOADED CLEANERS
FLEXIBLE SPIRAL BRUSHES
SQUEEGES

PIPELINE ACCESSORIES:

NIGHT CAPS
TIPTON PIPE CLAMPS
PIPE HOOKS AND TONGS
O.D. WINDMASTERS
TIPTON HI-PR PATCHES
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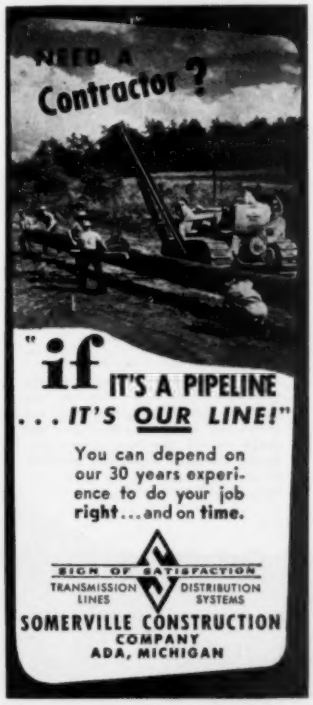
PIPESHINER BRUSHES
PIPE DOLLYS
RUBBER SCRAPER CUPS

ALL ITEMS IN STOCK

(WRITE FOR CATALOG)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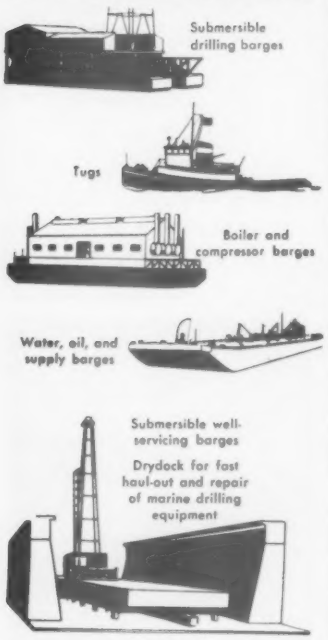
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Tugs
Boiler and compressor barges
Water, oil, and supply barges
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Drydock for fast haul-out and repair of marine drilling equipment

Lavingston is not only located conveniently with respect to marine drilling operations on the Gulf Coast, but here you will find marine engineers and constructors who understand the language of oil operators. Bring your marine petroleum equipment problems to Lavingston *first* for a quick economical solution.

Lavingston
SHIPBUILDING CO.
Orange, Texas

under way for some months, earlier this week the company received final authorization to proceed with the actual construction when Gov. G. Mennen Williams of Michigan signed a bill permitting construction across state lands. Previously, Lakehead had secured the necessary permits from other Michigan regulatory bodies.

The completion of this extension will enable Lakehead to deliver crude oil the year 'round direct to markets in Minnesota, Wisconsin, Michigan, and adjacent areas within the United States, as well as Sarnia, Ont.

When completed late this fall, the Lakehead and Interprovincial pipe-line system will constitute the world's longest crude-oil pipe line. The system will be 1,765 miles long and will span half the North American Continent.

Economically this combined pipe-line system will link the rapidly expanding Canadian crude-oil fields with United States and Canadian markets. Completion of the project in the fall of 1953 will contribute materially to the security of both the United States and Canada.

Products Line Proposed From Billings to Glendive, Mont.

OMAHA.—Williston Basin Pipe Line Co. is being organized for the purpose of building a 244-mile, 8-in. products pipe line from the refining area of Billings and Laurel to Glendive, Mont.

Construction will start as soon as pipe is available, according to M. M. Meyers, vice president. His headquarters are at 522 Insurance Bldg., Omaha.

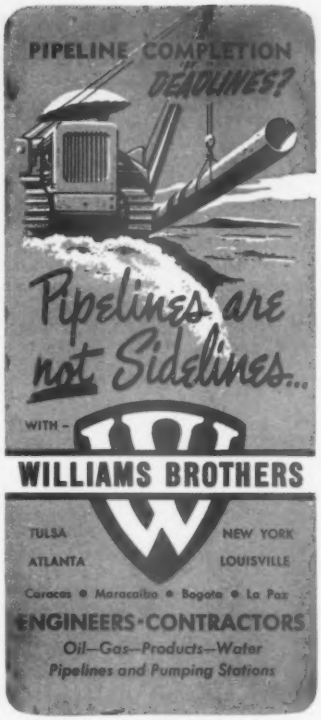
It is expected that products for the line may be procured from the Farmers Union Central Exchange, Inc., refinery at Laurel, which has a crude capacity of 13,500 bbl. daily.

At Billings there are two refineries: Carter Oil Co. has a 22,000 bbl. plant and Continental Oil Co. an 8,889 bbl. plant.

Gulf Interstate Motion on 860-Mile Line Denied

WASHINGTON. — A motion by Gulf Interstate Gas Co., Houston, to omit the intermediate decision procedure in proceedings on its application to build an 860-mile natural gas pipe line from southern Louisiana to northeastern Kentucky has been denied.

The Federal Power Commission completed hearings on the company's application March 11. Granting of the motion would have omitted the filing of an intermediate decision by the FPC examiner who conducted the hearings.



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HOUSTON, TEXAS

Additional Pipe-Line Radio Facilities Approved by FCC

WASHINGTON.—Construction permits for two-way radio facilities to serve various pipe-line installations throughout the country have been issued by the Federal Communications Commission in recent weeks. Included are the following projects:

... **Sinclair Pipe Line Co.,** Independence, Kans., three base stations on 153.17 meg. at Montgomery and Flynn, Tex., and at temporary locations in Iowa, Missouri, Illinois, Texas, Oklahoma, Kansas, and Indiana; three base stations on the same megacycle band near McPherson, Raymond, and Rosalia, Kans., two controls on 456.05 meg. near Eureka and El Dorado, and one fixed relay on 457.55 meg. near Rosalia, Kans.; and for 195 mobile units on 153.17 meg. in Texas, Oklahoma, Kansas, Missouri, Iowa, Illinois, Indiana, and Wyoming.

... **Platte Pipe Line Co.,** five mobile units on 158.31 and 158.43 meg. between Wood River, Ill., and Casper, Wyo.

... **Sohio Pipe Line Co.,** one base station on 153.29 meg. at temporary locations in Illinois, Kentucky, and Indiana.

... **Michigan - Wisconsin Pipe Line Co.,** one base station on 48.90 meg. at Waukesha, Wis.

... **Interstate Oil Pipe Line Co.,** Shreveport, one mobile relay on 153.29 meg. near Bridger, La.

... **Manufacturers Light & Heat Co.,** one base station at Wheeling, W. Va., on 33.38 meg.

... **Texas Illinois Natural Gas Pipe Line Co.,** one base station on 33.30 meg. near Joliet, Ill.

... **Humble Pipe Line Co.,** one base station on 48.86 meg. near Houston.

El Paso Wins Court Test

WASHINGTON.—The United States Court of Appeals has ruled the Interior Department must give El Paso Natural Gas Co. the rights-of-way to finish its pipe line from New Mexico to California.

The ruling upheld a previous judgment against former Interior Secretary Oscar Chapman by the United States Court. Chapman had stipulated El Paso Natural must sign an advance agreement to build additional facilities to transport as a common carrier.

In its decision the Court of Appeals said all but a small part of the $40,000,000 San Juan basin line had been built in March 1951 when Chapman made the demand to the company.

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with MINERALIGHT Ultra-Violet (black light)
Don't pass up possible pay! Make positive core identification checks with new model MINERALIGHT SL long wave ultra-violet lamp.
PROVED BEST BY TEST FOR OIL SHOW ANALYSIS! Simple to operate. Lamp weighs only 1 lb. Models available for 110 volt AC or with adapter, 110 volt DC current. Battery operated model for field use holds lamp, has built-in viewer for daylight examination. Easily portable. Send for FREE brochure OG, "How to detect and analyze petroleum in oil surface samples with ultra-violet."

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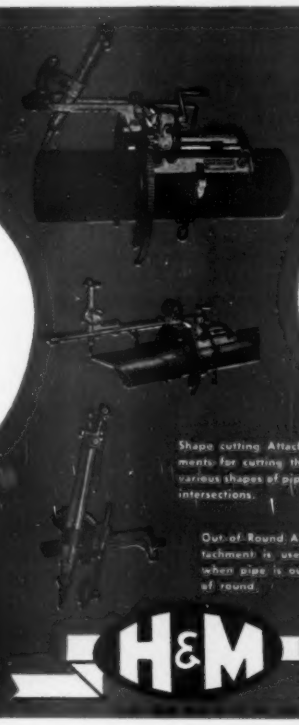
For Easier, Faster, Pipe Cutting & Beveling


Shape cutting Attachments for cutting the various shapes of pipe intersections.
Out-of-Round Attachment is used when pipe is out of round.

Economical...

With the economical H&M you can save up to half of the time and labor in cutting and beveling pipe. This portable but durable machine makes a complete cut and bevel in a 12 inch pipe in about two minutes.

See for yourself. Let us arrange a demonstration.

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NATURAL GAS

New Houston Natural Gas Production Co. Is Formed

HOUSTON.—Formation of Houston Natural Gas Production Co., a wholly owned subsidiary of Houston Natural Gas Corp., has been announced by Frank C. Smith, president of the gas u.lity.

The production company proposes to undertake a program of general exploration and its plans call for active participation in oil and gas development plus the acquisition of substantial gas reserves.

Holding the position of vice president and general manager of the production company will be Dr. Byron B. Boatright, consulting petroleum and natural-gas engineer.

Other officers of the company are: Frank C. Smith, president; J. H. Wimberly, executive vice president; John B. Cookenboo, treasurer; and Kenneth Fellows, secretary. Directors include Smith, Wimberly, Boatright, Cookenboo, and Joseph F. Wolff, of Corpus Christi.

Information Program Is Initiated By I.N.G.A.A.

DALLAS.—A public - information program designed to improve the public relations of the Independent Natural Gas Association of America and to increase the prestige of the natural-gas industry has been inaugurated by the association.

The final operating plan for the public-relations program was approved here recently by the I.N.G.A.A. public-information advisory committee and copies have been sent to the association's directors.

Bozell & Jacobs, New York agency, has been retained to help conduct the program.

Lone Star Gets Certificate

WASHINGTON. — Lone Star Gas Co., Dallas, has been awarded a temporary certificate by the Federal Power Commission to construct pipe-line facilities for storage of natural gas in New York City field, Clay County, Texas.

Estimated cost of the project is $1,144,617. It will include a 2,640-hp. compressor station and about 5 miles of 12-in. pipe line. The estimated maximum input into the storage reservoir will be approximately 20,000,000 cu. ft. per day and the company will be able to withdraw up to 80,000,000 cu. ft. daily.

Before the certificate expires on July 1, 1954 Lone Star must submit evidence proving the feasibility of the project.

NATURAL GASOLINE

Unique Plant

Hexanes used as absorbent in conventional absorber

BAKERSFIELD, Calif.—In Belgian Anticline field 35 miles west of here Union Oil Co. is operating a 3,500,000 cu. ft. natural-gasoline plant which is believed to be the first in which hexanes and heavier fractions are successfully being used as the absorbent in a conventional absorber.

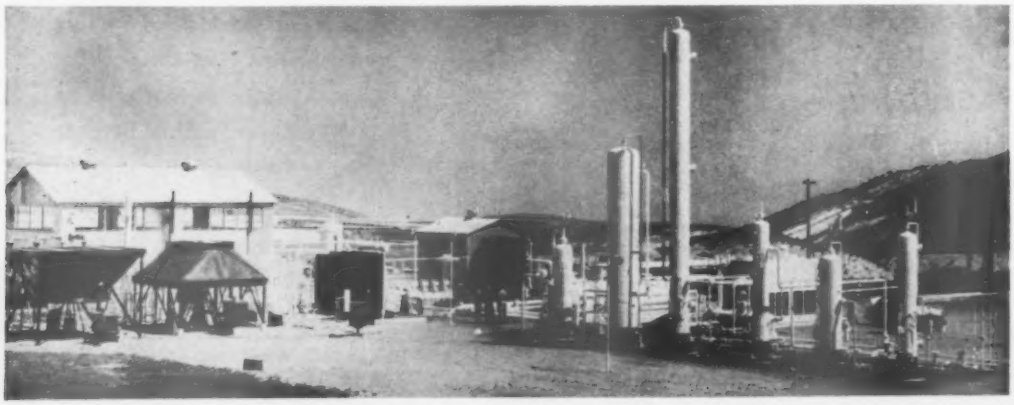
Approximately 85 per cent of the liquefiable gasoline fractions are being recovered by the plant, which was designed by Union personnel. In recovering 5,000 gal. of 40-lb. product daily, the butanes and lighter fractions are being extracted by absorption and the heavier fractions by refrigeration.

Due to the low molecular weight of the absorbent, unusually low lean-oil circulation rates of 7 or 8 gal. per 1,000 cu. ft. are being used. Light fractions then are stripped from the absorbent by circulating the bottoms from an oil conditioner through a reboiler heated by hot high-stage (500 psi.) compressed gases.

No steam used . . . No steam-generating facilities are thus used. This fact, plus extensive use of automatic controls and other design features, permits the plant to operate with only the lease pumper as attendant. Almost all power is supplied by oil-field-type gas engines.

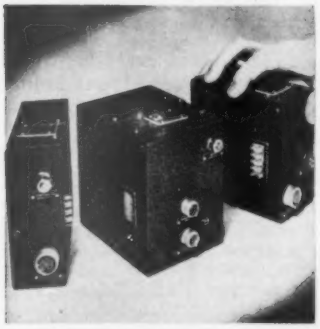
While not quite as efficient as most absorption plants, its lower cost permitted it to be built when a conventional plant could not be economically justified. Its salvability likewise is much higher than that of usual plants. Thus if gas supplies decline at a relatively early date, most of the equipment can be used by the production department in other fields.

(A description of this unique plant will appear in the Journal's annual Field Processing Issue April 27).



UNION OIL CO.'S natural-gasoline plant near Bakersfield, Calif.

REFINING



THESE THREE 7-in.-high units comprise the entire electronic assembly of the new mass flow meter. They may be used together or separately. Should an accurate measurement of just flow-in-gallons is desired, integrator (center) and indicator drive (right) may be used together with sensing unit. If continuous density alone is desired, unit at left could be used along with density detector and any standard indicator.

Mass-Flow Measure

Unit makes possible check on continuous liquid flow

NEW YORK.—Continuous liquid-flow measurement in terms of pounds per hour is now possible through use of a new device recently introduced by Gavco Corp. The gravimetric-flow measuring system, weighing 8 lb., is compact, environment-proof, and accurate.

It comprises a sensing unit which measures volumetric flow in a line, a density detector which simultaneously weighs samples of the passing fluid, and an electronic integrator which compensates flow for the true weight of the fluid and sends pulses to a dial indicator. It will handle flow rates up to 60,000 lb. per hour, measuring volume to within 0.5 per cent and weight to within 1.0 per cent. It provides continuous measurement of volume, density or mass, and can be employed with all standard controlling, recording, and indicating equipment.

For jet checks . . . The new tool was designed specifically for use on jet engines whose performance is a factor of the mass rather than the volume of fuel feed rate. It has other potential uses in the continuous measurement and control of fluid flow in chemical and refining processes where density of reactants is a factor in process efficiency. In solvent extraction, it can measure and control solvent ratios, and Gavco anticipates wide application in speeding testing operations in laboratory and development research. Models for measurement of gases, slurries and suspensions are now in design.

Commercial units applicable to clean liquid flow measurement are now available for about $1,250. This introductory price should be reduced with expected mass production, however.

"Hot" TEL To Promote Study Of Engine-Deposit Formation

LOS ANGELES.—Radioactive lead in tetraethyl lead will promote the study and correction of deposit formation in internal-combustion engines.

Just how was reported recently by Dr. H. P. Landerl and Dr. B. M. Sturgis of E. I. du Pont de Nemours & Co., Inc., before the national American Chemical Society here.

Previously it has been impossible to trace the various stages of growth of lead deposits in combustion chambers. New insight into this study results from adding radioactive TEL to the gasoline for only a short period of time during an experimental engine run. Following the run, an X-ray film placed over the combustion-chamber surface indicates the location and degree of deposition that took place during the short interval of charging the radioactive TEL.

Previous studies have shown that after many hours of engine operation, relatively large pieces of the deposit have flaked off, the authors reported. Their experiments with "hot" TEL now show that much smaller particles of deposit are breaking off all the time that the engine is running.

As they break off, they melt and then stick to another part of the cylinder. This migration or transfer within the engine, say the authors, plays an important role both in deposit formation and scavenging.

A.S.T.M. Corrects Factors For Viscosity Conversion

NEW YORK.—The American Society for Testing Materials, Committee D-2 on Petroleum Products, has voted to correct the factors used in converting from kinemtic viscosity to Saybolt Universal viscosity. This change will become effective July 1.

The change was made necessary by a recent correction by the U. S. Bureau of Standards, in the absolute viscosity

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STEAM and MECHANICAL
ATOMIZATION
COMBINED . . .
NATIONAL AIROIL
DUAL STAGE
OIL BURNER

Now, at last, the inherent advantages of both systems of fuel oil atomization are *profitably* yours . . . within the one, new NATIONAL AIROIL Dual Stage Burner.

41 years of combustion equipment design and manufacture are in back of the Dual Stage Oil Burner . . . and, it has been thoroughly tested and proved in the field for firing: Petroleum Processing Heaters; Rotary Kilns; H. R. T., Scotch Marine and Water Tube Boilers; etc.

Available in three sizes, the NATIONAL AIROIL Dual Stage Burner fires all grades of fuel oil from No. 2 to No. 6, with a ready capacity of 80 to 300 g.p.h. Further, for a perfect flame pattern, we would recommend using with the Dual Stage Burner either the NATIONAL AIROIL Universal Register for forced draft or, the NATIONAL AIROIL Tandem Units for natural or induced draft furnaces.

Get detailed description, illustrations, and specifications in NATIONAL AIROIL Bulletin 25.

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Ever stop to think what causes excessive belt wear? Misalignment of sheaves, inaccuracy of groove angles in relation to each other, belts not properly matched with one another or with sheaves,—belts not oil, water or steam resistant?
Wood's complete drives are job-engineered to eliminate these "belt-killers." Sheaves and V-belts are made for your requirements. Write our Dallas office for further particulars.

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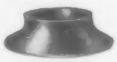
Nozzle sizes from 1/4" to 24"

ASTM A234

Also for pressure vessel heads



Nominal pipe sizes 1" to 24"

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of water. The unit of measure in kinematic viscosity is the centistoke, which is related to the centipoise, in turn based on the absolute viscosity of water. The old definition of a poise (100 centipoises) was the viscosity of water at 69.33° F.

The changes will not affect the direct measurement of Saybolt Universal and Saybolt Furol viscosities in the standard Saybolt viscosimeter by A.S.T.M. designation D 88-44. Corrections will be made in the values to be used in A.S.T.M. Designation D 446-39, the Standard Method for Conversion of Kinematic Viscosity to Saybolt Universal Viscosity. The revised conversion factors will be made public as soon as they are completed.

Suntide Refining's New Plant To Be Finished Soon

CORPUS CHRISTI, Tex.—The first steel tower was recently hoisted into place at the new Suntide Refining Co. refinery, now under construction here.

The tower is part of the crude topping unit, which is expected to be on stream in August, followed by a new catalytic cracking unit in September, according to T. C. (Ted) Bodley, vice president.

The 33,000-bbl. plant is located on a 134-acre site and will be a complete refinery, producing jet fuel, aviation gasoline, motor fuels, diesel oil, and Bunker "C" fuel oil.

Lummus Co. holds contract for construction of the plant.

New Chemical Plant Being Built in Texas City, Tex.

TEXAS CITY, Tex.—A new chemical plant is under construction here for Texas City Chemicals, Inc.

The $7,000,000 plant will be used to produce dicalcium phosphate, sulfuric acid, and also for uranium recovery. Plans call for "spent" sulfuric acid obtained from nearby Carbide & Carbon Chemicals Co. to be used in the production of dicalcium phosphate. Sulfuric acid will also be produced from elemental sulfur and sold to Carbide.

Officers of the firm are: R. L. Wheelock, chairman of the board, Corsicana; W. L. Pickens, president, and E. H. Koeph, vice president and general manager, both from Dallas; and H. H. Coffield, Rockdale, secretary-treasurer; S. A. Winfrey, Dallas, is executive vice president.

Refining Briefs

FREEPORT, Tex.—A new polyethylene plant will be built by Dow Chemical Co. here, according to Dr. A. P. Beutel, vice president and Texas division general manager. Construction of the plant facilities prior to plant production is estimated to take between 18 to 24 months. Negotiations for patent licenses and technical knowledge have been made with Imperial Chemical Industries, Ltd., a British firm. Polyethylene is a plastic which is used in manufacture of plastic pipe, shower curtains, packaging film, and wire and cable coating.

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when the snake strikes...you have 10 minutes!

...this requires dependable, controlled suction to prevent the poison from spreading. In the New Improved Saunders* Kit, all components are packed for quick, easy use. Only the Saunders* pump carries a performance *guarantee*. Easy to operate by the victim alone if necessary. FITS ALL STANDARD UNIT TYPE FIRST AID KITS. When advisable can be carried on the person in belt pouch. Write for details.

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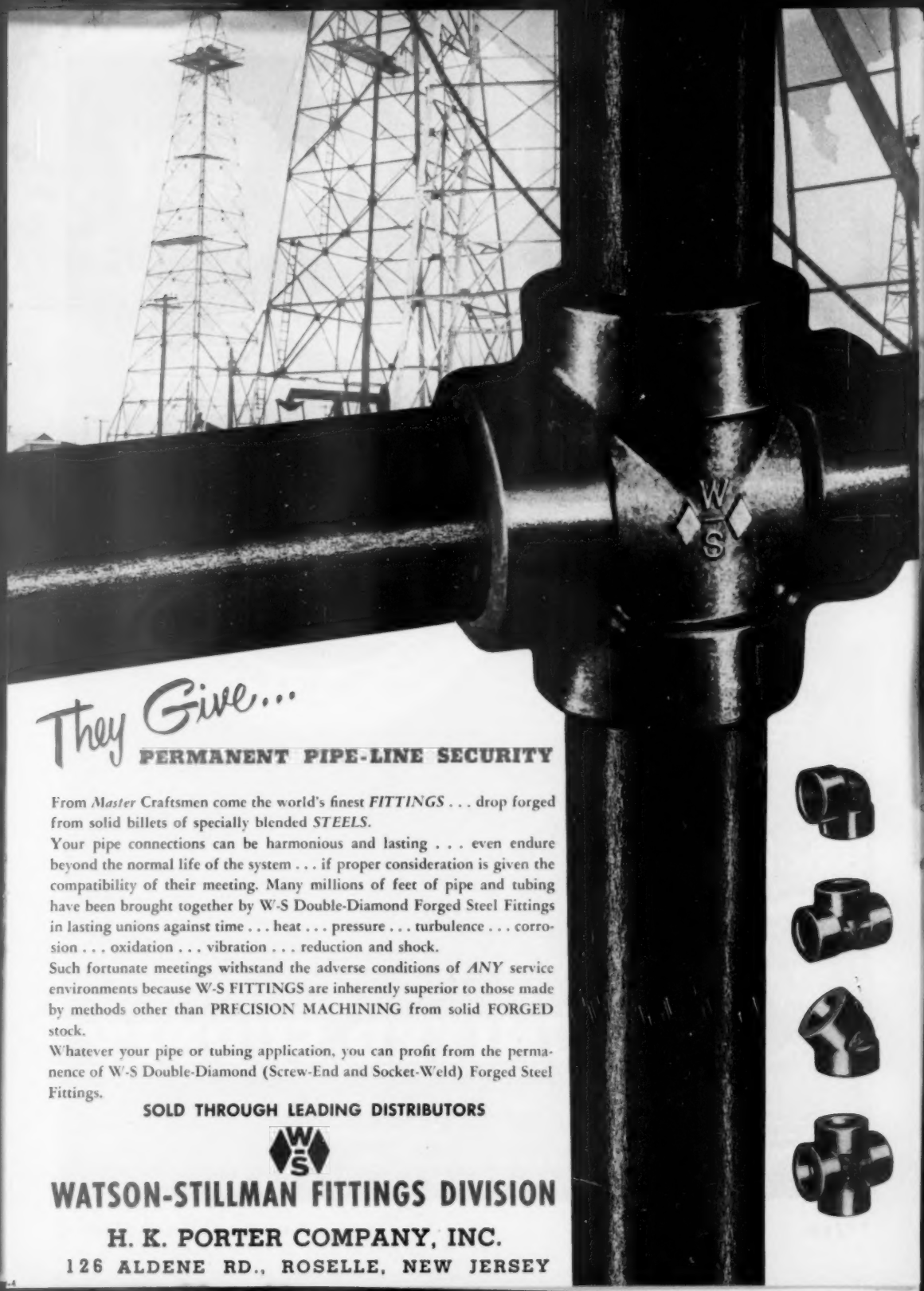

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Your pipe connections can be harmonious and lasting . . . even endure beyond the normal life of the system . . . if proper consideration is given the compatibility of their meeting. Many millions of feet of pipe and tubing have been brought together by W-S Double-Diamond Forged Steel Fittings in lasting unions against time . . . heat . . . pressure . . . turbulence . . . corrosion . . . oxidation . . . vibration . . . reduction and shock.

Such fortunate meetings withstand the adverse conditions of *ANY* service environments because W-S FITTINGS are inherently superior to those made by methods other than PRECISION MACHINING from solid FORGED stock.

Whatever your pipe or tubing application, you can profit from the permanence of W-S Double-Diamond (Screw-End and Socket-Weld) Forged Steel Fittings.

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that are famous for dependability and service — available in complete stocks at your United Supply store.

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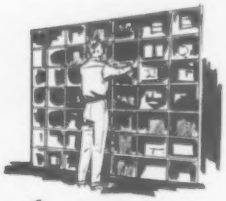
United Supply trucks are always ready day or night to take care of your every need.



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These "reasons why" are important to you in your drilling and production operations—they mean that United is ready with a supply service to save you both time and money. United Supply has a 16-year reputation for courtesy, service, and dependability—and we are delivering a better service every day. Call your United Supply store and see for yourself.

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COURTESY — SERVICE — DEPENDABILITY

Among the Drilling Contractors

Drilling Pick-up Boosts Number of Active Rigs

Rotary rigs operating in the United States and western Canada during the week ended April 6 (latest report) totaled 2,656, an increase of 17 over those running the preceding week. Although still under the "high" of two weeks ago, the total was more than 75 greater than at the same time a month ago, when the number reached its lowest level this year. It was more than 300 below the number of active rigs a year ago.

Drilling in Oklahoma during the week was at the highest level it had been at any time since the first of the year. Increases in drilling also were evident in all other areas except West Texas and New Mexico, Kansas, and western Canada. There was a decrease of 27 in the number of rigs running in the West Texas-New Mexico area.

ACTIVE ROTARY RIGS*

(United States and Western Canada)

Area—	Week ended 4-6-53	Change week ended 3-30-53	Change week ended 4-7-52
Gulf Coast	587	+ 2	— 41
N. & W. Tex.-N. M.	805	—27	—261
Ark.-N. La.-E. Tex.	131	+10	— 18
Oklahoma	337	+16	— 1
Kansas-S. Nebraska	178	— 2	— 12
Illinois-Eastern	100	+11	+ 4
Rocky Mountains	200	+12	+ 23
Pacific Coast	166	+ 2	+ 7
Total U. S.	2,504	+24	—299
Western Canada	152	— 7	— 19
Total	2,656	+17	—318

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and the Gulf Coast and Arkansas - North Louisiana - East Texas areas are shown on pages 195 and 196.

Long Brothers Drilling Co., Oilton, Tex., has a new wildcat operation under way 12 miles southwest of Freer, in southern Duval County, southwestern Texas. Contract is for Sid Katz at 1-A Peters.

Sierra Drilling Co. is making hole below surface in a wildcat test being contracted for Morris Cannan and Creslenn Oil Co. in the area 6 miles southwest of Raisin, in Victoria County, lower Texas Gulf Coast. Location is at 1 Buchholz, in the F. G. Hidalgo Survey. Contract is for 6,000 ft. This contractor also has a new operation under way for Mebane & Cannan of San Antonio in the Christmas field, De Witt County. The latter well, 1 Hex Green, Jr., in the Dolores Aldrete League, is scheduled for 7,000 ft. Location is 3,400 ft. northeast of the discovery producer.

Southern Production Co., Fort Worth, is starting another well, the third, for California Co. in the new Norco field, west of New Orleans, in St. Charles Parish. Location is for 3 U. S. A., about ¾ mile east of two previously completed wells, in which pay zone is in a 9,200-ft. sand.

Merrick Drilling Co., Wichita Falls, Tex., is drilling on a new 6,100-ft. contract it has with D. M. Wallace of Houston for a wildcat test, 1-A Miller, in Jackson County, Texas Gulf Coast. Location is 4 miles southwest of Edna, in the Juan Fernandez Survey.

El Dorado Drilling Co., El Dorado, Ark., is contractor on a new test which J. L. Foster and Lawton Oil Corp. are starting at 1 Patterson, in the NW SE SE 19-16s-14w, 1½ miles southeast of the Calion field, northern Union County, Arkansas. Objective is the Travis Peak around 4,000 ft.

Kern-Trimble Drilling Co., Magnolia, Ark., is keeping a rig busy in the new West Fouke field, in Miller County, southwestern Arkansas, where it is drilling for Murray Petroleum Co. Latest operation is 1 Willis-Wiegel, in the NW NE NW SW 21-17s-27w, to which the rig has been moved from 2 Wiegel, completed as the confirmation well for the newly opened Paluxy sand at 3,750 ft.

Kern-Trimble Drilling Co., Magnolia, Ark., has a new contract operation under way in the North Stamps field, Lafayette County, Arkansas, where it is drilling for McAlester Fuel Co. It is a 2,700-ft. lower Cretaceous test at 1-A Ravencraft, SE SE SW 5-16s-23w.

Arrow Drilling Co., Dallas, is starting a 7,000-ft. well for Atlantic Refining Co. at 1-D Still in the North Lansing field, 8 miles northwest of Hallsville, Harrison County, East Texas. Location is in the A. B. Wyatt Survey. This contractor also has a contract with Cities Service Oil Co. for a semi-wildcat test, 1 Laird, in the new area 2½ miles southwest of Wortham, Lime-

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stone County, also in East Texas. The latter location is in the Sarah McNulty Survey.

Coats Drilling Co., Gladewater, Tex., is moving a rig to a wildcat location 6 miles east of Pine Mills, Wood County, East Texas, where it will drill 1 McCullough, in the Bailey Martin Survey, for John C. Robbins, Jr.

Coleman Drilling Co., Jennings, La., has contracted with General Gas Corp. of Baton Rouge for 2,000-ft. wildcat test, 4 Fee, to be drilled 2 miles west of Gibsland, in 16-18n-7w, Bienville Parish, northern Louisiana.

Butler-Johnson Service Corp., Shreveport, is starting another well for Mid-Century Oil & Gas Co. in the Longstreet field, DeSoto Parish, northwestern Louisiana. The new operation, 1 Scheller, in 5-13n-15w, is projected to the Gloyd zone around 5,450 ft.

Berg & Buck Drilling Co., Shawnee, Okla., will drill two wells for Powel Briscoe, of Oklahoma City, in the Northeast Lockridge gas-distillate area, southern Logan County, Oklahoma. Both wells, marking a revival of development in the above field, are projected to 6,400 ft. The wells will be 2 Ploeger, in the NW NW NW 27-15n-4w, and 2 Brouchoud, in 28.

Marlow Drilling Co. is contractor on a projected 6,000-ft. test being started 6 miles south of Idabel, in the extreme southern part of McCurtain County, in the southeast corner of Oklahoma. Operator is Frank Walters of Pernell, Okla. Location is in the C SE NW 8-9s-24e.

Rine Drilling Co., Wichita, is drilling a Mississippian test for Cities Service Oil Co. at a wildcat location, 1-A Interstate, 6½ miles southwest of the Greenwood gas area, in Morton County, in the southwestern corner of Kansas. Location is in the SE SE NW 19-34s-43w.

E. A. Rumley, Oklahoma City, has moved in tools for a 10,700-ft. wildcat test he has contracted to drill for Benson & Montin of Oklahoma City east of Albert, in Caddo County, southwestern Oklahoma. Location is for 1 Hennessey, in the C SE SE 19-9n-11w.

Frank W. Frawley Drilling Co., Midland, Tex., has the contract for Sunray Oil Corp.'s latest test in the Northwest Branch area of Acadia Parish, Louisiana Gulf Coast. The new test, 1 Clemons Fontenot, in 80-8s-2e, is southeast of production. It will go to 11,500 ft.

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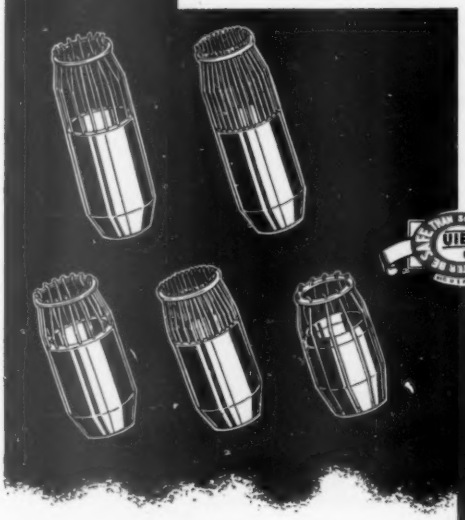

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EXPLORATION

Williston Wildcatting to Increase

by Philip C. Ingalls

THE next few months can be expected to see a marked increase in the number of wildcat wells completed in the Williston basin.

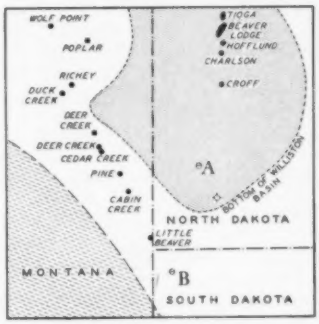
Seismic prospects, developing since oil was discovered in North Dakota 2 years ago, are now scheduled for testing. A yet greater impetus to the pending activity, however, is the number of farmouts that are brewing as a result of unfulfilled drilling commitments.

Despite a mild winter, wildcat activity in the Williston basin has been relatively modest in recent months. Subnormal prices of oil resulting from lack of pipe lines has deterred some operators from all-out activity. The principal reason wildcat activity has not been commensurate with the interest in the basin's potentialities, however, has been the need for time to digest geophysical and geological studies for sound wildcat locations. Much work has been accomplished during the past 2 years. Wildcat drilling to evaluate acreage without the benefit of detailed geological and geophysical work, which has not been generally successful, will gradually be replaced by scientific locations.

That portion of the Williston basin shown on the accompanying sketch map has seen the most significant developments to date. Nearly all of the oil that has been discovered in this area has been on long-known surface-expressed structures detailed by seimic work.

A recent assured dual-zone discovery on the Baker-Glendive anticline between Pine and Little Beaver has kept interest high in the potentialities of the 100-mile-long structure. Shell Oil Co. 22-33 Cabin Creek unit, NW SE NW 33-10n-58e, Fallon County, Montana, is reported to have found more than 400 ft. of effective oil-saturated Madison for the first Mississippian production on the anticline. This wildcat, now coring ahead below 8,377 ft., has also been assured of commercial production in what are believed to be Devonian rocks at 8,247-8,377 ft.

On the southeast along the Baker-Glendive anticline, Carter Oil Co. 1 Hendricks, SW NW 2-20n-3e, Harding County, South Dakota, B on map, is fishing at 8,220 ft. This wildcat on the Gallup dome is believed to be in the top



Portion of Williston basin.

of the Ordovician, primary objective of the test. Two 8,000-ft. tests drilled about 20 miles to the southwest of Carter's wildcat cut expanded Black Hills sections of Mississippian and Ordovician rocks, but no Devonian as known in the deeper parts of the Williston basin to the north. Tops reported for 1 Hendricks show 24 ft. of Devonian.

A noteworthy exception to the general rule that most of the oil fields in the area covered by the sketch are on seismic-located structural bubbles atop regional features is the one-well Wolf Point field discovered last December by Continental Oil Co. This discovery well, drilled to evaluate a large lease block, was staked on the basis of regional geology only. The discovery's production is not impressive (185 bbl. of oil and 65 bbl. of salt water on pump from the Mississippian) but the well indicates the productive possibilities of the area of thinning section westward from the Poplar anticline toward the Bowdoin dome of North-Central Montana.

Amerada Petroleum Corp. is preparing to drill its first Williston basin well off the Nesson anticline. The 1 Herman May, NW NW 9-139n-100w, Billings County, North Dakota, A on map, will attract high interest due to its location in the extensive productionless area between Little Beaver on the Baker-Glendive anticline in Montana to Croff field on North Dakota's Nesson anticline. The wildcat is located about 28 miles north and west of Stanolind Oil & Gas Co. and Deep Rock Oil Corp. 1 Brusich, a dry hole drilled to 11,152 ft. which had some shows of oil in the Mississippian at about 8,600 ft.

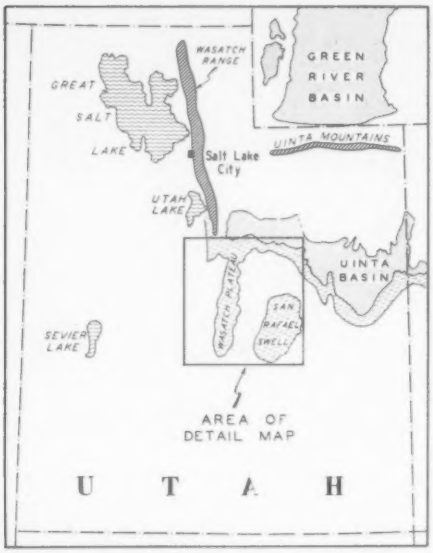
The Williston basin, though still on a high horse as far as lease prices are concerned, is gradually becoming a normal producing province. The continued movement of operators into the area and the successful tailoring of exploration and well-completion techniques to the area indicate that the basin is scheduled for solid growth for many years.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

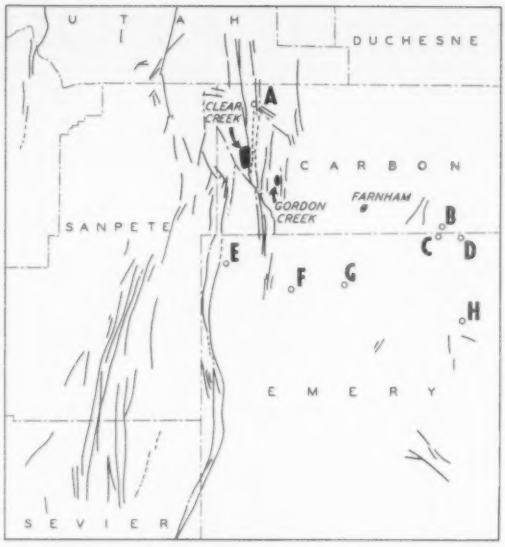
OKLAHOMA . . . The confirmation well of Southwest Navina pool, Logan County, has entered the second Wilcox pay zone. Macmillan Petroleum Corp. et al 2 Krout, SW NE SW 14-15n-4w, is drilling below 6,545 ft. Operators will drill through the sand, run log and set casing.

SOUTHEAST NEW MEXICO . . . Amerada Petroleum Corp. 1 Schenck, Lea County, long southwest offset to the Bronco (Devonian) discovery in Yoakum County, Texas, and second well for the new pool, plugged back to the Devonian after drilling and testing to the pre-Cambrian. First production tests gaged 543.59 bbl. of oil in 23½ hours through ¾-in. choke.

KANSAS . . . Anderson-Prichard Oil Corp. has a possible Lansing discovery in northwestern Kansas on the west flank of the northern end of the Central Kansas uplift at 1 Pollnow, NE NW SW 4-3s-29w, rank wildcat 19 miles northwest of Jennings pool, Decatur County. The Texas Co. is coring ahead after gaging 7,500 M.c.f. of gas per day in the Simpson at 1 Springer, NE NE SE 23-31s-6w, rank wildcat 17 miles east of Grabs pool, Harper County.



PRINCIPAL FEATURES of physiography and tectonics of Central Utah and adjoining areas. (Fig. 1).



HIGH-FAULTED CHARACTER of anticlines of Wasatch Plateau is revealed on this map of Central Utah. (Fig. 2).

Central Utah Gas Search Intensifies

Exploration stepped up in highly faulted anticlines on Wasatch Plateau; San Rafael swell receiving attention

by Joseph A. Kornfeld
District Editor

WASATCH Plateau and San Rafael swell in Central Utah comprise one of the most intensive drilling programs in search of gas in the Rocky Mountain province. Eight exploratory wells and four development tests are active in Carbon, Sanpete, and Emery counties; these wells are located from 90 to 160 miles south and east of Salt Lake City. (See Figs. 1 and 2.)

Objectives . . . Cretaceous gas sands, proved prolific at Clear Creek and Gordon Creek fields in Carbon County in the past 3 years, are being sought among highly faulted structures of the Wasatch Plateau. East of the Wasatch highlands, gas reservoirs are being sought on the San Rafael swell in possible reservoirs extending from the pre-Cretaceous rocks down into the Pennsylvanian system.

Clear Creek Gas Field

The most important natural-gas field found to date on the Wasatch Plateau is Clear Creek field in western Carbon County. Surface geological work revealed a broad terrace traversed on its east side by a north-south fault, down thrown to the east. Mapped vertical displacement is 500 ft.

The discovery well, completed November 1951, was located on the west, upthrown side of the fault. It was Byrd-Frost, Inc., 1 Utah Fuel Co. near the C W/2 SW SE/4 5-14s-7e. Initial production was 3.55 million cubic feet of gas per day produced through a 26/64-in. choke; flowing pressure was 945 psig. Heat content of the gas measures 990 B.t.u. Sample tops are: Emery 850 ft., Bluegate 2,450 ft., and Ferron 4,340 ft. The well was drilled to 4,761 ft., total depth, and plugged back to 4,711 ft., and is productive from Ferron sands below 4,690 ft.

To date, seven gas wells have been completed from various lenses in the Ferron sandstone series. Three rotary drilling rigs are active currently on the Clear Creek structure. Wells are completed using high-pressure gas from nearby wells as a circulating medium.

Three States Natural Gas Co., formed from a merger of Byrd-Frost, Inc., and other interests, operates Clear Creek field. Mid-Continent Petroleum Corp. has an important working interest in the field. Proved developed natural-gas reserves of Clear Creek gas field are estimated to be 290 billion cubic feet, possibly more.

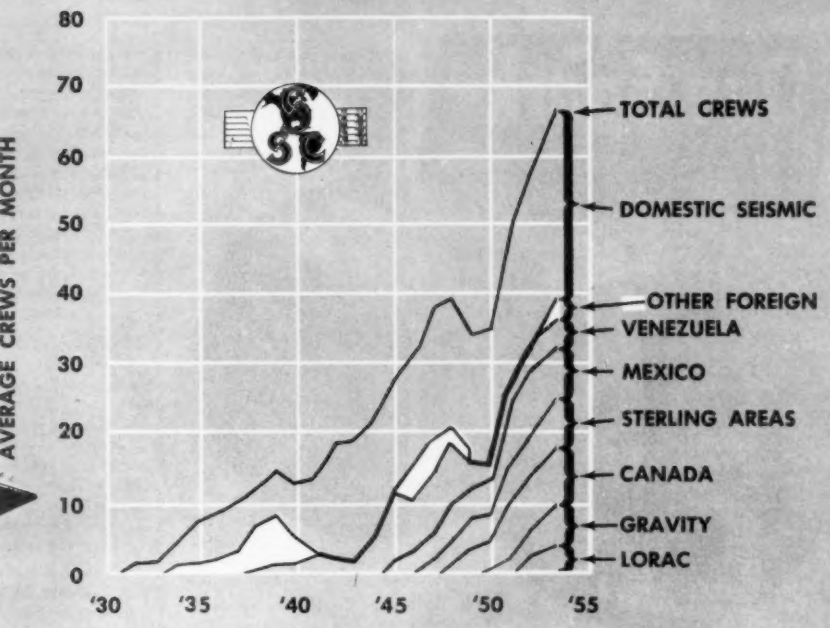
Gordon Creek Gas Field

The second structure on the Wasatch Plateau to produce from the Ferron sandstone series is the Gordon Creek structure. During 1952, Pacific Western Gas Co. 3 Unit, NW SW SE 19-14s-8e, 5 miles southeast of Clear Creek field production, was completed flowing 1.5 million cubic feet of gas per day from 3,416 to 3,516 ft. in the Ferron sands.

Gordon Creek Unit, officially formed on June 20, 1946, by Pacific Western Oil Corp. comprises 26,126 acres lying in Townships 13, 14, and 15 south, Ranges 7 and 8 east.

Carbon Dioxide Reservoirs

One of the deepest exploratory wells drilled on the Wasatch Plateau was Pacific Western 1 Unit, C SE NE 24-14s-7e, on this structure in western Carbon County. During 1948, this well



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was drilled to a total depth of 12,146 ft. in the Coconino (Permian) sandstone where it tested about 12 million cubic feet of gas with a high content (98.75 per cent) of carbon dioxide. Fish was lost in the hole and the well was whipstocked and redrilled into the Sinbad (Triassic) formation encountered at 10,877 ft. where it was completed as a carbon dioxide gas well in May 1948. Initial gage was 8.5 million cubic feet of gas per day. Flowing well-head pressure was 2,700 psig. while being tested through a ⅜-in. choke on tubing.

Farnham . . . The first carbon dioxide gas field of the area was discovered in January 1924 near the town of Farnham in southern Carbon County. Carbon dioxide gas was produced from a 20-ft. zone in the Coconino (Permian) sandstone encountered at 3,086 ft. Structural extent is estimated at 1,300 acres.

Exploratory Drilling
Carbon County

North and east of Clear Creek (Ferron) gas field about 7 miles, a showing estimated at 1 million cubic feet of gas per day was reported from the Ferron sand series late in February 1953 at Three States Natural Gas Co. 1 Wasatch Land & Cattle Co., an exploratory test. This well in C NW NE 22-12s-7e, (A on map) had this showing on a drill-stem test at 6,005-6,109 ft. Tool was open for 4 hours and gas rose to surface in 9 minutes. On last field report, this well was drilling below 7,563 ft.

Mounds structure . . . About 2 miles north of Mounds, but in southern Carbon County, Equity Oil Co. 1 Mounds-Government, C SW NE 33-15s-12e (B on map) flowed an estimated 1.5 milion cubic feet of gas per day late in 1952 from a plug-back depth of 4,614 ft. after drilling to a total depth of 9,360 ft., following a 150-qt. shot at 4,164-4,614 ft.

Emery County

Southwest of the above described well, Equity Oil Co. 2 Unit, NE NW 4-16s-12e, (C on map) set casing at 4,536 ft to test showings logged to 4,678 ft.

Grassey Trail prospect . . . East of this well about 3 miles, Cities Service Oil Co. in the same month recovered 1,620 ft. of oil and gas-cut mud from an interval from 3,880-3,951 ft. at an exploratory test on the Grassey Trail prospect in central northern Emery County. At this well (D on map), 1 Government, C NE NW 1-16s-12e, the last reported formation top was the Moenkopi (lower Triasic) encountered at 3,471 ft. This well is drilling below 6,662 ft. and will be drilled to 7,500 ft. into Pennsylvanian rocks.

Plant Canyon prospect . . . Southwest of Clear Creek gas field about 15 miles but on the Flat Canyon structure in western Carbon County, Three States Natural Gas Co. 1 Mary D. Kearns, NW NE 27-16s-6e, (E on map), original test on this structure, is now shut down at a total depth of 6,149 ft. When this well was drilled last year, there was recovered on a drill-stem test from 6,050-85 ft., a good gas blow during a 1-hour test; recovery in drill pipe was 3,475 ft. of heavily gas-cut mud. At a lower level, core recovery from 6,108-49 ft. was sandstone with some porosity and good gas odor.

Huntington anticline . . . Phillips Petroleum Co. has staked location for an exploratory test on the Huntington anticline unit, 3 miles northwest of Huntington in the northwest corner of Emery County. It will be drilled to 11,000 ft. and will test the Pennsylvanian rocks. Description is 1 Government (F on map), SE NW 15-17s-8e (SLM).

East of Huntington about 8 miles, Anderson & Brockbank is drilling below 357 ft. at an exploratory test at 1-X McMullin, SE NW SW 12-17s-9e (G on map).

Packsaddle prospect . . . East of the Wasatch Plateau area proper but in the San Rafael swell plateau, El Paso Natural Gas Co. is drilling below 3,800 ft. on an exploratory test on the Packsaddle prospect (H on map). This well, 1 Packsaddle, SE NE SE 12-18s-12e, is 24 miles east of Castledale in north-central Emery County.

Sanpete County

Joes Valley anticline in Sanpete County in the heart of the Wasatch Plateau will be tested during the spring of 1953. Three States Natural Gas Co. of Dallas plans to move in a rig to test the northern end of the anticline.

Physiography . . . The Wasatch Plateau lies in the central part of Utah. It extends from the Price River southward to White Mountain and Musinia Peak for about 85 miles. The Wasatch is the northeasternmost of Utah's high plateaus.

The Wasatch Plateau is bounded on the east by Castle Valley. Its western boundaries are the Sevier and Sanpete valleys. Surface elevation of the plateau ranges from 9,000 to 11,300 ft. above sea level. In surface relief, it ranges from 3,000 to 6,500 ft. above lower-lying lands on the east and west.

A high tableland, the Wasatch Plateau is a part of the great highland rim of the Colorado Plateau region which forms a broad curve from western Colorado to southwestern Utah.

Northward, the Wasatch joins with the highland which lies between the Wasatch Mountains and the Uinta basin. Southward, the Wasatch merges with other high plateaus through a lower tableland dissected by the Ivie and Salina Creek valleys.

Structure . . . Prominent fault zones traverse the Wasatch Plateau such as North Gordon, Pleasant Valley, and Joes Valley.

These faults have resulted in prominent topographic features. Pleasant Valley and Joes Valley features have produced imposing scarps. Sunken blocks of some fault zones have formed large valleys. Structurally higher blocks have caused formation of well-defined mesas. Stream courses have been altered greatly by these faults.

Utah Public Service Commission recently held hearings in Salt Lake City on application by Utah Natural Gas Co. (El Paso Natural Gas Co. subsidiary) to construct a $6,500,000 natural-gas transmission pipe line from Wasatch Plateau gas fields. The 16-in. line would extend from Clear Creek field northwestward for 96 miles. Initial designed capacity would be 50 million cubic feet per day; in the second year of operation, 100 million cubic feet per day would be moved through the line.

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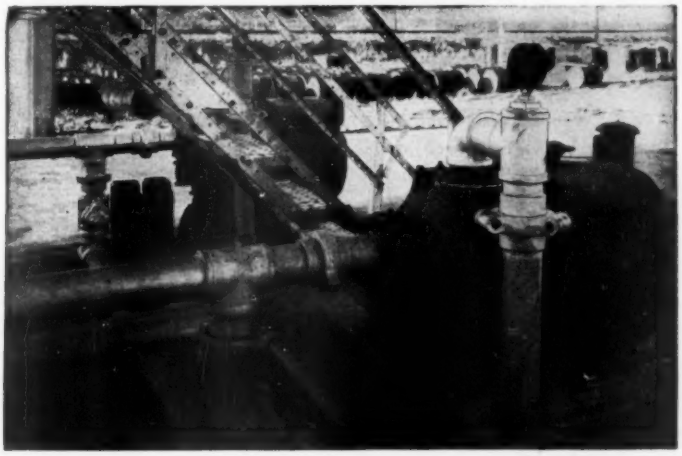

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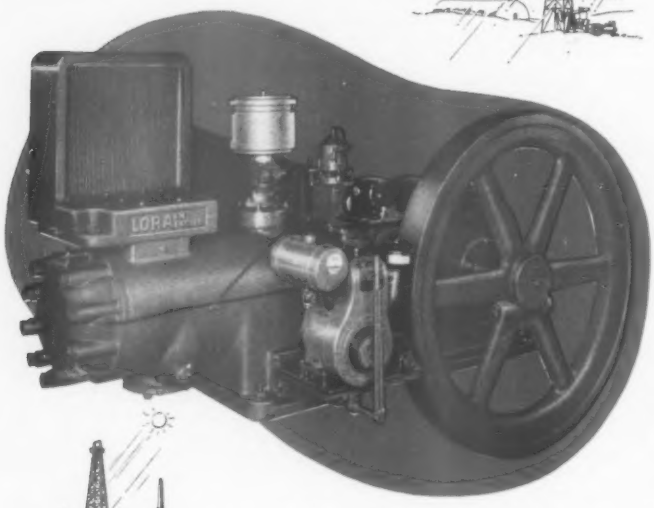

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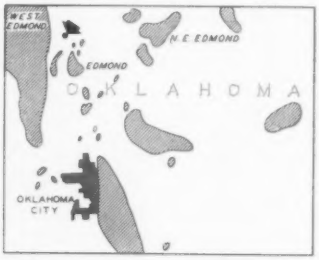
OKLAHOMA

Big Gas Blow Reported At Coal County Test

A big gas blow is reported at a Coal County wildcat in southeastern Oklahoma.

Harry H. Diamond, Inc. 1 Spence, NW NW SW 6-2n-8e, Coal County, is rated up to 15,000 M.c.f. of gas per day following initial blow and cratering from a shallow sand at a depth of 1,914 ft. The wildcat blew out at 1,914 ft. and operator may set pipe if the flow is not killed.



Arrow indicates two-zone gas-distillate discovery 4 miles northwest of Edmond, Oklahoma County. Calvert Drilling Co. and Huffman & Malloy et al. 1 Salisbury is shut in after an excellent initial flow. Pay zones are the second Wilcox sand and Simpson dolomite. The discovery flowed at the rate of 100 bbl. of distillate and 10,000 M.c.f. of gas per day from the second Wilcox, and 8,000 M.c.f. of gas per day with a distillate spray from the Simpson dolomite.

The new indicated discovery is located 1½ miles east of Stonewall and northwest of last year's Northwest Tupelo discovery. Coal County has an intensive wildcat program under way this year with four tests in progress at the present time. Development at East Oconee pool is picking up considerably this year, also.

New Beaver Discovery

A new Morrow sand discovery or extension is being completed in the Oklahoma Panhandle's Beaver County.

Aladdin Petroleum Co. 1 Cobb, C NE NE 16-6n-20eCM, flowed gas at the rate of 4,440 M.c.f. plus a distillate spray. Pay is the Morrow sand perforations at 6,162-90 ft. after acid-fracture treatment.

The new discovery is north of Lorena, west of Light field, and about 1½ miles south of the Southeast Liberal area of Seward County, southwestern Kansas.

Garfield Activity

Exploratory and development work in northwestern Oklahoma's Garfield County continues to be steady.

Southwest of Northeast Prairie Valley pool W. C. McBride, Inc., and Portable Drilling Corp. 1 Mae McPherson, stepout test in the NE NE NE 7-23n-4w, is drill-stem testing in the Mississippian. At the north end of the pool Mercury Drilling Co. will drill 2 Cogswell heirs in the NE SE NW Section 5, a northeast offset to the 1 Cogswell heirs.

North Lucien pool is due more development work. The pool was revived last year with a second Wilcox producer. Mora Drilling Co. will drill 1 Rupp in SE SW NE 36-21n-3w.

The pool is located on the Garfield-Noble County line.

CALIFORNIA

Oil Search Revived In Merced County

Merced County, which lies at the northern end of San Joaquin Valley and so far solely a minor gas producing area, is beginning to feel the results of an intensive land play which has been under way for the past several months. Two wildcats have been staked and it is expected at least four more will be started in coming months.

The two new tests, in central Merced, were Wm. R. Whittaker Co., Ltd., 1 Whittaker-Murietta and E.A.S. & Associates 1 Gay. The former was staked in 23-9s-10e, about 7 miles north of the town of Los Banos; the latter in 36-10s-9e, approximately 4 miles southeast of the town.

Shell Oil Co. in the near future is expected to stake location for two new tests and Richfield Oil Corp., which has acquired approximately 100,000 acres of leases in the county, is scheduled to drill at least one.

During 1952 only one wildcat was drilled in the county; Shell Oil Co. 47X-19 Bliss, dry at 5,493 ft. It was drilled in 19-9s-15e, about 6 miles northeast of Chowchilla gas field on the Merced-Madera county line. Two shallow tests were drilled in 1951.

The new play has oil as the primary objective. Nearest crude production is Raisin City field in Fresno County, about 40 miles southeast.

Mountain View Given Deeper Pool

M.J.M. & M. Oil Co. apparently has added a new deeper pool discovery at Mountain View, near Bakersfield, by deepening an abandoned upper Miocene producer. Originally completed in the Wharton sand at 5,475 ft., the new operator drilled 3 Atlantic-Wible to 7,354 ft. On initial tests the well flowed at the rate of 15 bbl. hourly from perforations at 7,301-53 ft., in the Nozu sand of middle Miocene. M. J. & M. holds a farmout of about 600 acres in the vicinity of the test, which is in 23-30s-28e, on the west side of the field.

Lost Hills Find Completed

Tide Water Associated Oil Co. has completed its 14-17 Farnsworth as a new field discovery 5 miles northwest of the old Lost Hills field. Drilled to 2,769 ft., the wildcat was completed pumping 19.3°-gravity crude at the approximate rate of 100 bbl. daily through perforations at 2,728-68 ft. Location of the successful wildcat is in SW NW 17-25s-20e. General Petroleum Corp. and Superior Oil Co. are expected to shortly start step-out tests.

Washington, Oregon Tests Planned

J. D. Bodkins, independent operator of Midland, Tex., plans starting a deep test in both Washington and Oregon later this year. Location of the two tests, both to go to around 10,000 ft., is to be announced upon completion of geological work in the latter part of the year.

Bodkins reportedly holds extensive leases in both states, including holdings in Wheeler,

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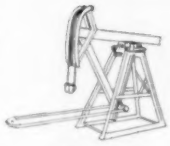

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Crook, Deschutes, Harney, and Malheur counties of central and east Oregon and Walla Walla, Whiteman, Adams, and Grant counties in southeastern Washington.

Later this month Standard Oil Co. of California will spud 1 Seifert in Lewis County, near Chehalis, Wash. Located in 4-14n-3w, the wildcat will be the company's first test since early 1950 and its fourth attempt in the state since 1946. It will be about 60 miles southeast from the Ocean City area, Grays Harbor County, where Union Oil Co. and Tom Hawksworth wildcats found good oil shows but not in commercial quantities.

KANSAS

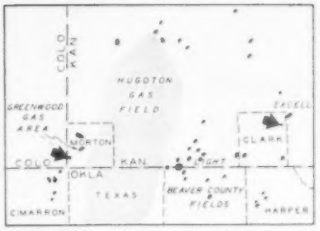
Two Rank Wildcats Slated in Hugoton Area

The southwestern Kansas portion of the Hugoton embayment has two new rank wildcats under way.

In Clark County Saturn Drilling Co. has a new wildcat in progress at 1 Yoeman, NE NE NE 3-31s-21w, 16 miles northeast of Clark's Ashland pool and about 4 miles southwest of Excell pool, Kiowa County.

Clark County has three producing areas: Ashland, Snake Creek, and Theis pools. The county is directly north of Harper County, western Oklahoma, where an important new Pennsylvanian gas-distillate discovery was made last year at South Laverne. Clark also lies northeast of active Beaver County, Oklahoma, where six new pools were opened in 1951, one of which has been abandoned.

Morton County . . . The expansion of Morton



Arrows indicate rank tests in Hugoton embayment area.

County's Greenwood gas area in the extreme southwestern corner of Kansas, directly west of the huge Hugoton gas field, received a boost with the staking of a new wildcat 6½ miles southwest of Greenwood pool. The new venture will be Cities Service Oil Co. 1 Interstate "A," SE SE NW 19-34s-43w. The wildcat will go to the Mississippian.

This new test is northeast of Cimarron County, Oklahoma's Keyes District gas fields and the new North Sturgis gas field which produces from the upper Morrow (basal Pennsylvanian) sand.

Greenwood field is Kansas' westernmost producing area. Development in the field has picked up considerable speed during the past few months. There are 10 tests in the area under way at the present time. Cities Service opened the gas area about 2 years ago. The field produces from the Morrow sand and Lansing lime of Pennsylvanian age.

Barton County Activity

Central Kansas' Barton County in the center of the Central Kansas uplift reports an active exploratory program under way.

There are currently six tests in progress in the county. Victor Drilling Co. and Deep Rock Oil Corp. are rigging up tools at 1 Sausen, NW NW NE 30-16s-14w, wildcat 3 miles north of Leoville pool and 1 mile northwest of abandoned Millard pool in the northwestern part of the county.

In the eastern part of the county Ash-Mar Drilling Co. is nearing the Arbuckle at 1 Kimpler, SE SE SE 31-18s-11w, 1 mile north of Kramp pool. The operator is below 3,300 ft. Also in the eastern part of the county Heathman & Co. is below 2,430 ft. at 1 Hines, SE SE SE 34-18s-11w, 1 mile north of Bernard pool.

Northeast of the city of Great Bend George Angle has staked location for a test 2½ miles west of North Ft. Zarah pool at 1 Wood, NW NW SE 15-19s-13w.

In south-central Barton County Petroleum, Inc., is below 2,800 ft. at a semiwildcat, 1 Tucker "D," SE SE SW 34-20s-13w, ½ mile north of Stafford County's Shaeffer pool. Fleming & Woodman et al. are rigging up at another wildcat in the southern part of the county at 1 Schermuly, NE NE SE 24-20s-13w, 1¼ miles northwest of Batchman pool and 1¼ miles south of Sunny Valley pool.

Barton County is one of the Central Kansas uplift's major producing areas. Six new discoveries have been completed in the county this year. In 1952 11 new pools were opened. More than 280 oil and gas wells were completed in the county's fields last year.

Marion Pool Opened

A new oil pool is being opened in north central Marion County in east-central Kansas at Anderson-Prichard Oil Corp. 1 Scully "A," SE NW NW 34-18s-2e. The wildcat is located 2 miles north and 3 miles west of Hillsboro pool.

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A drill-stem test in the Viola and Misener at 2,893-2,900 ft. recovered 820 ft. of clean oil and 40 ft. of heavily oil-cut mud. The northwest offset to the discovery well, 2 Scully "A," NW NW NW 34-18s-2e, recovered 600 ft. of clean oil and 40 ft. of oil-cut mud on test of the Misener and Viola at 2,903-12 ft.

LOUISIANA

SOUTH LOUISIANA

Second Sweetville Well Proves New Pay Horizon

Completion by Vincent & Welch, Inc., of its 2 Long Bell, northwest offset to its recently completed discovery well in the Sweetville area of Beauregard Parish, not only confirms oil production in the area but opens another pay zone, 200 ft. shallower than that of the discovery producer.

The new well, which flowed 199 bbl. of 44.9°-gravity oil in a 24-hour potential gage through 9/64-in. choke, produces from a Cockfield zone, perforated at 8,010-13 ft. Pay zone of the discovery well, 1 Long Bell, also is in the Cockfield but is open through casing perforations at 8,324-25 ft. The latter well was good for only 30 bbl. or 48.9°-gravity oil per day on a flow gage through 8/64-in. choke. It also carried some formation water.

Pay zone of the discovery well did not show commercial production in the second well, which was drilled to 8,610 ft. Hole is plugged back into the casing, cemented at 8,156 ft.

New Orange Grove Field Gets Confirmation Well

Discovery last January of production in the Orange Grove (Southeast Gibson) area, Terrebonne Parish, has been confirmed with completion by Ted Weiner of his 5 Wylie with a potential gage of 203 bbl. of 35.3°-gravity, pipe-line oil in 24 hours through 9/64-in. choke. Production is from the same 9,600-ft. Miocene sand (9,640-46 ft.) in which the discovery well, 2 Wylie, was completed flowing 292 bbl. of 36.2°-gravity, pipe-line oil per day through 10/64-in. choke. Both wells are in 84-17s-16e, and were drilled to depths of approximately 10,600 ft.

Drilling already is under way on another test, 3 Wylie, in the same section. Prior to completion of the discovery well, Weiner drilled two other deep tests in the area. Both had oil showings which were not considered commercially productive.

Second Oil Producer For Washington Field

The recent discovery of oil production in the Washington field, St. Landry Parish, has been confirmed with the completion by Sohio Petroleum Co. and Gulf Refining Co. of their 5 Thistlethwaite, located in 61-4s-4e.

The new well, the second oil producer, flowed 196 bbl. of 40°-gravity oil in 24 hours through 10/64-in. choke with 2,000 psi. pressure on the tubing and 1,350 psi. on the casing. Production is from a perforated interval of 7,852-58 ft. Total depth was 8,118 ft. with casing at 8,100 ft.

The field was discovered in 1952. Production, except in the last two wells, has been gas.

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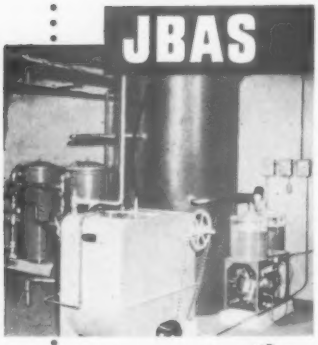

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Anse La Butte Extended

Deep gas-distillate production in the Anse La Butte area of Acadia Parish has been extended nearly ½ mile to the northwest with the completion by Stanolind Oil & Gas Co. of its 2 Chachere in 80-8s-7s-2e. On a 10-hour state potential gage, the well flowed at the rate of 35 bbl. of distillate and 1,155,000 cu. ft. of gas per day. Pressure on the tubing was 2,750 psi. and on the casing 2,850 psi. Gravity of the distillate was 62°. Pay is the "Chick" sand, topped at 8,430 ft. Hole is plugged back to 9,010 ft. from its original depth of 9,305 ft.

NORTH LOUISIANA

New Pay at Redland

Wildcat activity in March in North Louisiana resulted in one new discovery, a new oil sand at Bossier Parish's Redland field.

Continental Oil Co. completed 1 Stewart, 510 ft. from south line and 1,933 ft. from east line of Section 19-23n-12w, for the first oil well in the two-well gas-distillate field. The new discovery flowed 90 bbl. of 44°-gravity oil per day from the Travis Peak. The field's discovery well was finaled last year for gas-condensate.

March Geophysical Activity

Field exploratory work in North Louisiana during March amounted to 81 crew weeks. Of this total 70 weeks were with seismograph, 6 gravitymeter, and 5 with core drill.

Activity by parish is as follows: Bienville 7, Bossier 4, Caddo 1, Caldwell 4, Catahoula 5, Claiborne 8, De Soto 8, East Carroll 1, Grant 3, Jackson 1, Lincoln 5, Morehouse 2 seismograph, 1 gravitymeter, Natchitoches 1, Ouachita 8 seismic, 5 core drill, and 5 gravitymeter, Sabine 2, Tensas 1, Union 5, and Webster Parish 4.

Nacatoch Strike Due Red River

Noble & Baker and Associates have an apparent Nacatoch discovery in old Lake End area, southern Red River Parish. The discovery, 1 Bierden, Jr., SW NW NW 31-11n-9w, flowed 20 to 25 bbl. of 42°-gravity oil daily from the Nacatoch sand in open hole at 1,216-36 ft.

ARKANSAS

Three New Discoveries In State During March

Operators opened one new pool and two new pays in Arkansas during March.

A new Cotton Valley oil pool was opened east of the old Lisbon field in Union County at Montgomery 1 Brasher, C SW NE 14-17s-16w. A confirmation test has begun at the discovery. The structure on which the discovery was made appears to be limited thus reducing the possible producing area around the discovery.

In Village field, Columbia County, Ashland Oil & Refining Co. opened a new Cotton Valley sand pay at 3 Bond unit, C SW SE 10-17s-19w. Regular pay in the area is from the Smackover limestone.

At West Fouke field in Miller County a third producing zone was opened at Jay Simmons 1 Dildy-Wiegel-Willis unit, NE SW NW 21-17s-27w. The new pay is the upper Paluxy. The new upper Paluxy pay has been confirmed. The fields two pay sands now are the Tuscaloosa and the deeper Paluxy sand,

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both lenticular in nature, making correlation from well to well difficult.

Field Exploration

A total of 33 weeks were spent in Arkansas during March in field exploration work. Of the total 33 crew weeks, 18 were seismic, 8 gravitymeter, and 7 magnetic crew.

Test Running at Irma Wildcat in Nevada

A drill-stem test is being run at Ranney Exploration Co. 1 Reynolds, C SW SE SW 31-13s-20w, Nevada County wildcat in southwestern Arkansas. The test is located just north of Irma field Nacatoch sand production. The test will be run in the Travis Peak sand.

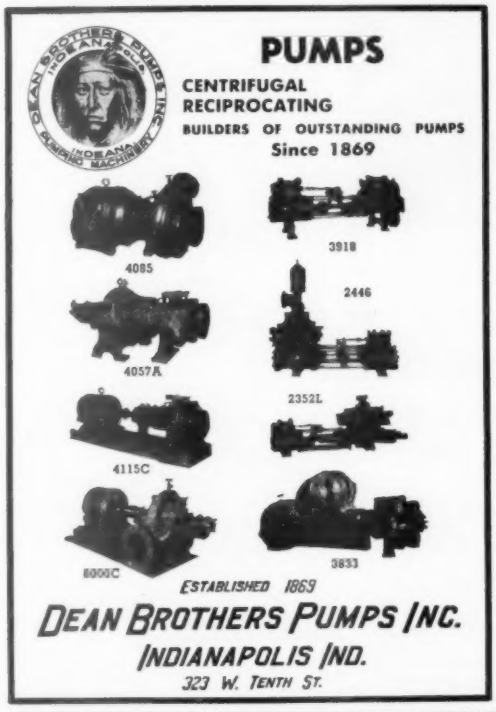
MICHIGAN

Acid Boosts Oil Flow At Mason Discovery

Acid appears to have substantially boosted oil flow from Dow-Brazos-Taggart Bros. Gas Co. 1 Dow-Brazos unit, SE NE NE 27-19n-18w, Hamlin Township wildcat discovery, Mason County.

Well is being produced and tested in the Niagaran following an acid treatment with 2,000 gal. Pay section from 4,276-85 ft. was acidized. On first 24-hour test, through various choke arrangements well flowed 180 bbl. of net oil and 47 bbl. of water in 24 hours. On a swab-flow test immediately after the treatment well flowed back all of the acidizing fluids plus about 87 bbl. of net oil and some water. Before being acidized well had been producing from 50 to 60 bbl. of oil a day, plus about 40 bbl. of water. The selective acid treatment did not appear to have increased the amount of water showing.

The 1 Dow-Brazos unit was originally drilled by Dow Chemical Co. as a test well for chemical brine supply for its Ludington plant. A basal Salina-Niagaran gas pay showed during these operations on drill-stem test, but the Niagaran oil pay, where all of the reworking under the joint operation of Dow, Brazos and Taggart Bros. was not tested during the drilling program by Dow. Dow tested the basal Salina-Niagaran gas pay, which has not been touched on the rework at 3,950-4,212 ft. Well was tested with tester open for 8 hours. Gas showed in 2 minutes and was estimated good for from 12 to 15 million cu. ft. of gas a day. Hole was bottomed out at 6,622 ft. When the



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joint rework arrangements were completed a bridge plug was set at 4,400 ft. and section from 4,224-4,326 ft. was perforated with 255 shots and it is from these openings that well is now being produced. This well appears to be by far the best Niagaran oil pay yet tapped in Michigan, and despite offset failures to the south and southeast, it is almost certain that additional Niagaran drilling will follow in this area.

APPALACHIAN AREA

OHIO

Wray Drilling Co. moved ¾ mile northeast of the Perry Township, Coshocton County, pool in an attempt to extend the pool. The test, 1 Howard Crowthers, Section 7, made 100,000 cu. ft. and a small show of oil natural and an estimated 200,000 cu. ft. and 15 bbl. in 24 hours after shot.

Wade Drilling 1 Rex Foglesong, Lot 25, Royalton Township, Cuyahoga County, a semiwildcat, made 130,000 cu. ft. natural and 200,000 cu. ft. when shutin after shot. Clinton sand was logged at 3,510-93 ft. with the pay at 3,558-61 ft.

Waverly Oil Works is drilling a wildcat to test the Clinton in the southeast part of Franklin Township, Licking County, on 1 William McInturf, fourth quarter.

KENTUCKY

EASTERN KENTUCKY

In Clay County, 8-F-72, Petroleum Exploration Co. have completed their 1 Bringardner Lumber Co. as a dry hole. This rank wildcat was drilled in the southeastern portion of the county about 2 miles north of the Bell County line. Important formational markers include: Big lime 2,260 ft., Corniferous lime 3,107 ft., Brassfield (Silurian) dolomite 3,405 ft., Richmond (Ordovician) 3,450 ft. Total depth was recorded at 3,543 ft.

In Isonville Pool of eastern Elliott County, Kentucky Ohio Gas Co. have a dry hole at their 1 R. Oliver in 16-S-78. Big lime was topped at 393 ft. and the prospective Weir (Mississippian) sand at 906 ft. Drilled to a total depth of 937 ft. the test showed oil but not in commercial quantities.

NEW MEXICO

SOUTHEAST NEW MEXICO

Chaves Wildcat Flows Siluro-Devonian Oil

Republic Natural Gas Co. and Seaboard Oil Co. of Delaware 1 White Ranch, Chaves County wildcat in 34-11s-29e, reported flowing oil from the Siluro-Devonian.

First test at 8,715-60 ft. flowed an estimated 30 bbl. of oil an hour, and recovered a pipe full of oil with no water. Operators cored ahead 15 ft. and recovered fractured dolomite with scattered vugs and pinpoint porosity, with some bleeding oil. Drill-stem test from 8,717-75 ft. had flowing oil in 29 minutes, at the rate of 91 bbl. hourly. Recovery was the pipe full of oil, plus 60 ft. of brackish water. Top of the Devonian in the 1 White Ranch was 8,735 ft., minus 4,943 ft.

Companies participating in the discovery are Union Oil Co. of California, United States Smelting, Mining & Refining Co., Louisiana

Land and Exploration Co., and DeKalb Agricultural Association. Location is about midway between deep production in the Chisum field to the west, and Pennsylvanian production on the west side of Lea County, to the east. Operators were running pipe for completion.

ROCKY MOUNTAIN

MONTANA

More Oil Recovered At Cabin Creek Discovery

An additional 3,050 ft. of oil was recovered on the latest reported drill-stem test of Shell Oil Co.'s Cabin Creek discovery in Fallon County.

The new test is in a lower section of the same formation tested a week ago for apparently commercial results to become the second pay zone in the well.

The two latest tests are believed to be in Devonian, although tops have not been released. On 2 and 1-hour test from 8,298-8,339 ft., the well made 3,050 ft. of gassy oil and 310 ft. of gassy, oily mud, 40-70 per cent oil. Flowing pressure was 920 psi., and shut-in pressure was 3,810 psi.

A similar test a week ago established the Devonian (?) as an important producing horizon in the wildcat, 22-33 Unit, NW SE NW 33-10n-58e. It had already shown about 400 ft. of producing section in the Madison group of Mississippian age in tests above the current level.

The discovery is south of Shell's production in the Pine Unit, and is on the basis of tests to date, one of the most important discoveries in the Williston basin campaign.

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Northern Montana Wildcat Has Questionable Shows

Socony-Vacuum Oil Co.'s Pegasus Division is coring below 6,494 ft. in F-11-6-P-Rhodes, C NW NW 6-33n-47e, in the Police Creek area of Daniels County, with cores above this depth showing bleeding oil, but generally hard and tight. Cores were comparable to those showing some oil in a recent failure 7 miles to the north of this wildcat which was abandoned in early 1953.

The extreme northeastern Montana area has been of considerable interest during recent months as a result of discoveries made several miles to the north, in Canada. Exploration through the area to date has not been successful in finding commercial shows.

NORTH DAKOTA

Bottineau County Wildcat Shows for Good Production

Smith & Summers of Bismarck recovered 45 ft. of heavily oil and gas-cut mud and 66 ft. of clean oil on 1-hour test of Madison from 3,064-74 ft. at the 1 Homme-Stone, C SW NW 31-164n-78w, in the Turtle Mountain area of Bottineau County, for another apparent discovery in this area. The wildcat is ¾ mile southeast of Ward-Williston Drilling Co.'s 1 Klokstad, which is reported making 50-90 bbl. of oil per day on 8-hour pumping periods for one of the best producers yet in this area. Smith & Summers are running casing for completion of the new discovery.

SOUTH DAKOTA

Youngblood & Youngblood of Oklahoma City has abandoned 1 Galvin, C SE SE 25-16n-22e, Dewey County, with total depth at 6,325 ft. in granite. No shows were reported in the well and drill-stem test of the Madison recovered only fresh water. These operators have drilled three unsuccessful wildcats in the Dakotas during the past year.

NEBRASKA

New "D" Sand Discovery Indicated in Cheyenne County

In the first of a series of five wildcats in Cheyenne and Deuel counties to reach critical depth, James P. Sloss, San Antonio has tested oil from "D" sand in apparently commercial quantities and is preparing for completion. The wildcat, 1 Thompson, NE NW SE 12-14n-51w, is about 5 miles west of Huntsman pool, in an area which has been rather active. Test of the "D" sand from 4,744½-53 ft. recovered 840 ft. of oil, 90 ft. of mud-cut oil and 100 ft. of water in 2 hours. The operator has set casing at 4,790 ft. after failing to find shows in the "J" sand.

COLORADO

Casing Run on Deep Weld County Wildcat

Sherrod and Apperson have set casing and are preparing to test shows in Permian at the 8 Gillette, C NW NW 9-9n-61w, in Keota field of Weld County. The wildcat is the first to show for possible commercial production in horizons below Cretaceous in the Denver-Julesburg basin.

Bottomed at 9,663 ft. the well will be tested first in the Big Blue zone at about 9,100 ft. where shows were recovered in cores. Tests will also be run on the Lyons (?) sand interval

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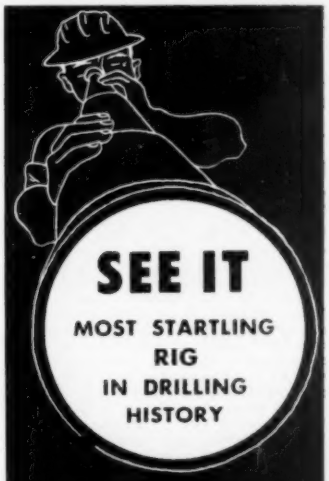

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which made 700 ft. of oil in 15 minutes from about 8,489-99 ft. Casing was landed at 9,250 ft. and the operator is cleaning out preparatory to testing.

In Logan County, Ryan Oil and associates have completed 1 State, NW NW NW 16-8n-54w, a mile southwest of Yenter field for a gage of 10 bbl. of oil per hour from the perforated interval 5,383-97 ft. The discovery opens a new field in the major production trend through this county. Production is from "J" sand.

WYOMING

Powder River Basin Flanks Get New Activity

Both the east and west flanks of the Powder River basin in Wyoming are scenes of new wildcat activity as drilling in the state starts a usual seasonal upturn. New locations were announced in the North and Middle Fork areas in Johnson County, where there has been little drilling since an important Tensleep discovery by Stanolind Oil & Gas Co., and Continental Oil Co. in 1951.

Howard Atha is drilling below 3,250 ft. at 1 Dawson, SW NE NE 19-44n-81w, and will test Tensleep at about 7,000 ft. The Chicago Corp. and Republic Natural Gas Co. has made location for a wildcat at 1 Harlan, NE NE NW 4-42n-83w, which proposes to test Madison at about 2,400 ft. Both these wells are of interest because of the lack of further work in this section of the western flank of the Powder River basin since the 1951 discovery.

On the east side of the basin there were six new wildcats staked in Niobrara and Weston County areas on the east side of the basin where exploratory drilling has not been heavy during the past several years. Recent discoveries and excellent extension completions in the South Clareton area of Weston County have contributed to new interest in the area.

TEXAS

WEST TEXAS

Runnels County Activity Includes Discovery

Runnels County activity last week was spiked with a good flowing discovery west of the Norton field, a prospective McMillan sand discovery, and two extension wells completed.

Melvin R. and Charles C. Lee 1 H. C. Daniel, Section 273, northeast of the town of Morton, completed for 221 bbl. of 42° oil a day, based on a 12-hour flow test, from perforations in the lower Cross Cut sand at 4,276-88 ft. Top of pay was 4,276 ft. on elevation of 1,793 ft.

T. W. Murray 1 Lindeman, D. Diaz Survey 532, developed 480 ft. of clean oil on a 1-hour drill-stem test between 2,533-36 ft. Operators planned to set casing for completion attempt in open hole at 2,535-36 ft.

Extension wells included E. P. Thomas and Ab-Tex Drilling Co. 1 Parramore, southwest of the Jim Burt-Caddo field, and Geochemical Surveys 2-Y J. W. Harris, located on the northwest side of the South Crews-upper Gardner field.

No. 1 Parramore flowed 122.7 bbl. of oil in 4 hours through 24/64-in. choke, from perforations at 4,396-4,410 ft., and was given a calculated daily potential of 733 bbl. Top of pay was 4,396 ft. on elevation of 1,782 ft.

The Harris well made 110 bbl. of oil a day through ¼-in. choke, from perforations at 3,852-58 ft. Top of the Gardner sand, and pay section, was 3,854 ft. on elevation of 1,835 ft.

Andrews development work . . . Stanolind Oil & Gas Co. et al 5-F Deep Fasken, southeast extension well to the Midland Farms-Ellenburger field, reported flowing oil on a drill-stem test in the Fusselman section at 11,875-968. Tentative top on the Fusselman was 11,880 ft., on elevation of 3,058 ft. On the test, oil surfaced in 70 minutes and gaged 35 bbl. in 30 minutes. Drilling continued after the test, on Ellenburger contract.

Sharples Oil Corp. and Associates 1-A Sharples-Means, reported additional pay section in the Strawn limestone. A 3-hour drill-stem test at 11,000-60 ft. recovered 270 ft. of clean oil and 210 ft. of about half mud and oil. Heavily oil and gas-cut mud was recovered on a test between 10,962-11,010 ft. Top of the Strawn at 10,962 ft. is high to the same marker in the Magutex discovery well, 4 miles to the east.

Stanolind 1-AE Midland Farms, Ellenburger test 2½ miles north of San Andres production in the field, and 4½ miles north of the Midland Farms-Ellenburger area, found middle-Permian oil on a drill-stem test at 4,793-4,847 ft. Recovery in 2 hours was 2,346 ft. of oil. Flowing pressured registered a maximum of 930 psi.

Reagan County . . . The Texas Co. 1-AF State, southeast offset to the West Big Lake-Ellenburger discovery, flowed 30 bbl. of high-gravity oil in 3 hours on a drill-stem test from 9,430-65 ft. Operators, however, called the section Fusselman and placed its top at 9,451 ft., minus 6,776 ft., which would be 280 ft. low to the pool opener on that formation. The discovery well completed in the Ellenburger at 9,410-9,500 ft. Drilling was to continue.

Dawson County . . . Northeast of the Snowden Spraberry field, Sun Oil Co. 1 Dean found shows of oil in a cherty limestone, possibly Mississippian, at 9,884-99 and 9,898-9,922 ft. The first section tested recovered water blanket and some 5 gal. of oil. On second test, recovery was the same amount of oil plus 30 ft. of oil-cut mud. Drilling continued.

NORTH CENTRAL TEXAS

Deep Well Slated for Sherman Field

Standard Oil Co. of Texas has made location for an 11,000-ft. test in the Sherman field, 1½ miles north of Sherman. The deep exploration will be 7 H. L. Rising in the J. B. McAnair Survey, A-763, and a short offset to the regular Strawn production in that area.

Another deep test which has set a depth record for the area, is Humble Oil & Refining Co. 1 Mark Williams, 3 miles northwest of Sandusky. Contract depth has been amended to 16,000 ft., and at last report the well wes drilling in shale at 14,198 ft.

Extension and new pay . . . In Jack County, a deeper Bend conglomerate pay has been added to the Marina-Mag pool at Russell Maguire 4 Craft, G. Gardinas Survey, A-125. Completion perforations were from 5,852-62 ft. and potential was 256 bbl. of oil a day through 16/64-in. choke. The new section is approximately 100 ft. lower than the regular pay horizon.

S. D. Johnson 2 R. H. Peterson, M. Putman Survey, A-465, has extended Strawn production ½ mile north of the Doug Johnson Strawn field in northwest Jack County. Completion potential was 260 bbl. of oil a day through 12/64-in. choke, from open hole at 3,231-41 ft. Nearest production in the field, however, is from a Strawn sand around 3,900 ft.

TEXAS GULF COAST

New DeWitt County Field Gets Confirmation Well

Deep Rock Oil Corp. is completing another well in the new North Mission Valley field, 3 miles south of Arneckeville, of DeWitt County, confirming the production found in its 1 Riesterer, located in the Thomas H. Bell Survey.

The new well, 2 Riesterer, flowed at the rate of 110 bbl. of pipeline oil per day during an 85-minute, preliminary drill-stem test after casing was performed opposite a sand interval at 8,273-76 ft. Flow was through ⅜ and ¼-in. chokes with 725 psi. pressure on the tubing. Bottom-hole pressure was 2,750 psi. while flowing and 3,650 psi. while shut-in. Gas-oil ratio was 1,000 cu. ft. per barrel. No water was indicated.

The well is bottomed at 8,337 ft. with 7-in. casing through the pay.

Georgetown Produces In New Fort Trinidad Well

Georgetown lime (lower Cretaceous) is proving productive in another well in the new Fort Trinidad field, on the Houston-Madison county line. The well, Woodley Petroleum Co. 2 Seven J Stock Farm, in the John Durst Survey, in Houston County, flowed 9 bbl. of oil per hour through ⅛-in. choke in early tests after pay was acidized. Production is from open hole at 9,128-41 ft. with top of the Georgetown at 9,100 ft.

Across the line in Madison County, The Texas Co. is testing another prospective well, its 2 Forrest, in the Samuel Larry Survey. This well, drilled to 9,600 ft., has casing run to 9,049 ft. Location of the latter is 2,216 ft. northeast of the company's first well, 1 Forrest.

SOUTHWEST TEXAS

Atascosa County Gets New Edwards Discovery

American Republic Corp. has an indicated gas-distillate discovery well in Edwards lime at its 1 Florence Wilson, a wildcat located 3½ miles east of Charlotte, in Atascosa County. Although no gage or estimate of production was made, the well, on tests through ⅛-in. choke, flowed gas and distillate under tubing pressure of 2,400 psi. The well has been shut in until separators can be installed for gaging. The Edwards lime pay is open through casing perforations at 7,455-71 ft., 7,512-14 ft., and 7,518-23 ft. Total depth is 7,527 ft. Location is southwest of the Jourdanton field.

Hidalgo County Wildcat Gets Gas-Distillate Flow

Tests of a 6,300-ft. sand encountered by Superior Oil Co. in its 1 Johnson, a rank wildcat in the E. P. Prue 206 Survey, 16 miles north of Mission, Hidalgo County, virtually have assured the opening of a new gas-distillate producing area.

In one packer test of casing perforations at 6,305-15 ft., the well, on a 4-hour gage through 24/64-in. choke, flowed at the rate of 5,780,000 cu. ft. of gas and 35 bbl. of 55.6°-gravity distillate per day, showing 10 per cent fresh water. In another 4-hour test through 16/64-in. choke, the flow was at

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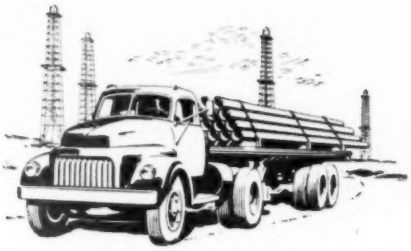

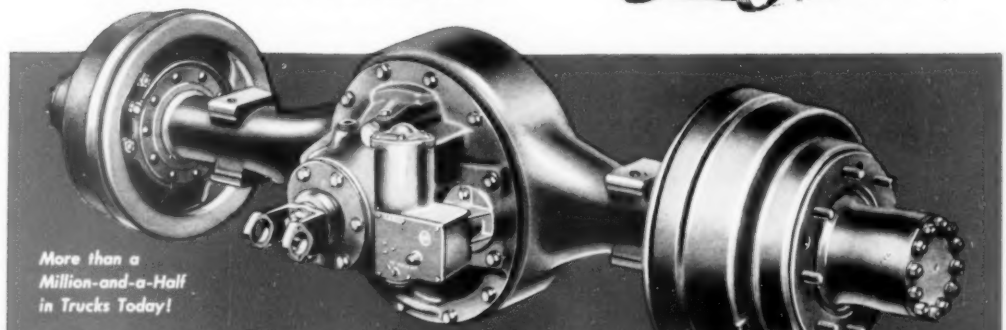

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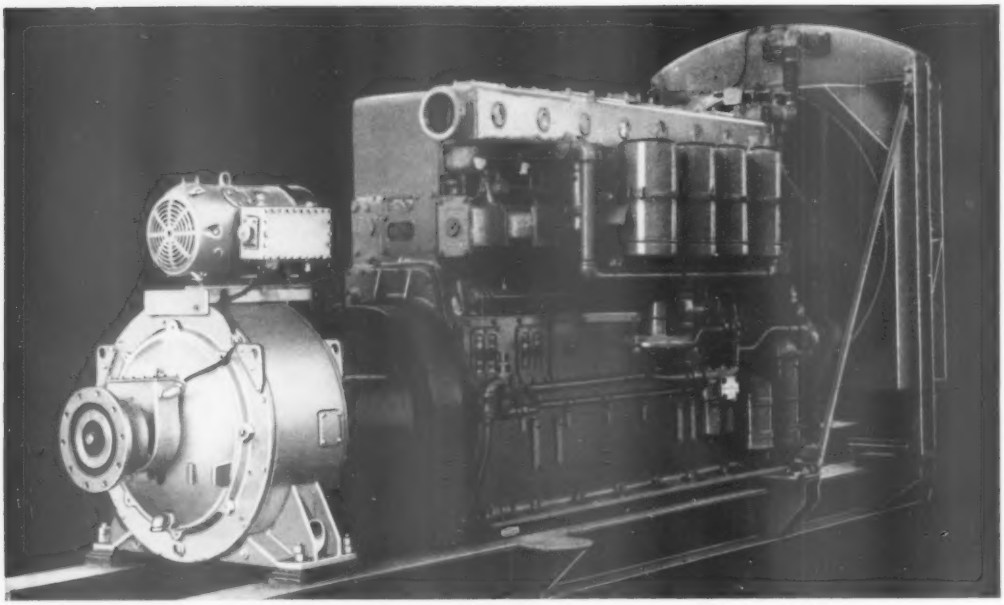

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the rate of 3,100,000 cu. ft. of gas and 19 bbl. of distillate per day with 6 per cent fresh water. Tubing pressure was 2,350 psi.

Operators have been testing a succession of sands up the hole from a total depth of 11,051 ft. Tests in the 6,300-ft. sand have been the most favorable so far.

MISSISSIPPI

Black Warrior Wildcat Produces Gas on Tests

Testing is still under way at Vaughey & Vaughey's prospective gas-discovery well, 1 U.S.A., in northern Chickasaw County, in the Black Warrior basin of northeastern Mississippi. At latest report, the well was flowing at the rate of 288,000 cu. ft. of gas per day through ⅛-in. choke with 850 psi. pressure on the tubing and 940 psi. on the casing.

With this flow, the well still was cleaning following the second fracture treatment of the uppermost of three Evans-sand zones. The zone is open through casing perforations at 2,409-21 ft. A bridge plug, set at 2,426 ft. separates this zone from the two lower zones, one with casing perforated at 2,429-34 ft., and the other with perforations at 2,444-48 ft. Previous tests of the lower two zones failed to get recoveries.

At the start of the present testing of the uppermost zone, the well flowed at an estimated rate of 760,000 cu. ft. of gas per day with tubing pressure gaging 528 psi. Some operators believe that when the well is completely clean of the fracturing fluid, production will be substantially increased.

WILDCAT COMPLETIONS

SOUTHWEST TEXAS

Aransas County: Sun Oil Co. 1-A State, Tract 98 in Copana Bay. Dry. TD 10,114 ft.

Union Producing Co. 9 Tatton, H. Knighton Sur., A-89. Dry. TD 10,314 ft.

Atascosa County: Thomas A. Kendall 1 Boothe, John O'Neil Sur. 1191. Dry. TD 1,884 ft.

Bastrop County: Emory A. Dunnam 1 Denison, I. Harris Sur. Dry. TD 3,708 ft.

Frio County: Forest Oil Corp. 2 Halff & Oppenheimer, I. & GN Sur. 1106, A-708. Dry. TD 3,954 ft.

Texita Oil Co. and Guy E. Chapman 1 Berry, M. C. Patton Sur. 1178, A-542. Dry. TD 3,184 ft.

Guadalupe County: Maple C. Hughes 1 Pfullman, L. Bollinger Sur. ⅓ Lge. Dry. TD 2,076 ft.

Hidalgo County: Western Natural Gas Co. 1 Patrick, Sec. 53, Missouri-Texas Land & Irrigation Co. Subd., Los Westenas Grant. Dry. TD 10,883 ft.

Jim Hogg County: Sid Katz and R. H. Venable 4 Premont, J. G. Gonsales Sur. 636. Dry. TD 5,010 ft.

Jim Wells County: George E. Farenthold 1 Knolle et al, Lots 1 and 2, Blk. 10, J. M. Gallagher Subd., Casa Blanca Grant. Dry. TD 6,125 ft.

Gust Tsesmelis 1 Hobbs, Los Presenos Grant, A-281. Dry. TD 5,850 ft.

San Patricio County: Lee Brothers 1 Schroeder, J. M. and N. Delgado Grant. Dry. TD 4,992 ft.

Webb County: Amerada Petroleum Corp. 2 Traylor & Nunley, I & GN Sur. 25. Dry. TD 6,620 ft.

Wilson County: H. H. Howell 3 Evans, Jose F. Rodriguez Sur. 21, A-263. Dry. TD 4,518 ft.

TEXAS GULF COAST

Bee County: Dallas Husky 1 Gill, A. S. Mangum Sur., A-386. Dry. TD 4,035 ft.

Producers Corp. of Nevada 1 Beasley, William Allen Sur., A-336. Dry. TD 5,010 ft.

Sparta Oil Co. 1 Sugarek, Edwin Morehouse Sur., A-231. Dry. TD 4,320 ft.

Brazoria County: E. Cockrell, Jr., 2 Chilton et al, Austin & Williams Sur., A-145 (Stratton Ridge area). Dry. TD 4,868 ft.

Continental Oil Co. 1 Perry, J. C. and G. W. McNeel Sur., A-91. IP 2,217 M.c.f. daily, 20/64-in., casing perforations in Miocene sand 2,448-60 ft. TD 6,802 ft. New pay in Allen Dome field.

Colorado County: Warren Petroleum Corp. 1 Koehn, J. H. Dabney Lge. Dry. TD 9,217 ft.

Fort Bend County: Fort Bend Oil Co. 1 Rohan, William Lusk Sur., A-276. Dry. TD 7,240 ft.

Goliad County: Currie B. Davis 1 Huggins et al, M. Jesus y Barbo Sur., A-51. Dry. TD 4,005 ft.

Kirkwood & Co. and Hawn Brothers 1 Chilton, J. F. Payne Sur., A-232. IP BOPD, P-32 choke, 31°, casing perforations 8,094-98 ft. TD 8,141 ft. Extends Weesatche West field.

Harris County: Austral Oil Exploration Co. 1 Schuenmann et al, William A. Schuenmann Sur., A-1605. Dry. TD 7,503 ft.

H. E. Brunson et al 1 Bayliss, William Scott Lower Lge., A-65. Dry. TD 6,636 ft.

Jasper County: American Republics Corp. and Houston Oil Co. 1-B Hughes, Henry Webb Sur., A-42. Dry. TD 7,891 ft.

Karnes County: Forney & Winn and William

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WILDCAT COMPLETIONS

McBride Love 1 Kunkel, Don Erasmo Seguin Sur. 2, Dry. TD 4,031 ft.

Live Oak County: F. W. Carr 1 West, Cameron County School Land Sur., A-146. Dry. TD 7,855 ft.

Jones & Young 1 Riser et al, Ed Ramirez Sur., A-394. Dry. TD 4,150 ft.

Matagorda County: Magnolia Petroleum Co. 1 Savage, Lot 12, Blk. 8, Subd., J. C. Payton Sur., A-74. IP 7,280 M.c.f. daily and 258.5 BCCPD 14/64-in., 49.7°, casing perforations 11,246-54 ft. TD 12,013 ft. Extends Wadsworth area.

Tyler County: American Republics Corp. and Houston Oil Co. 3 Rice et al, BBB & C Sur. 9, A-154. Dry. TD 6,460 ft.

EAST TEXAS

Cherokee County: E. C. Johnston 1 Mrs. Mary E. Lowry, C. B. Jennings Sur. Dry. TD 4,449 ft.

Mack Hays Jr. 1 Decker Bros., James Dill Sur., A-13. Dry. TD 5,514 ft.

* Freestone County: Bradley & Sherar 1 R. V. Bounds, W. T. Ritchie Sur. IP 22 BOPD, ½-in., 24°, pay 950 ft., TD 979 ft.

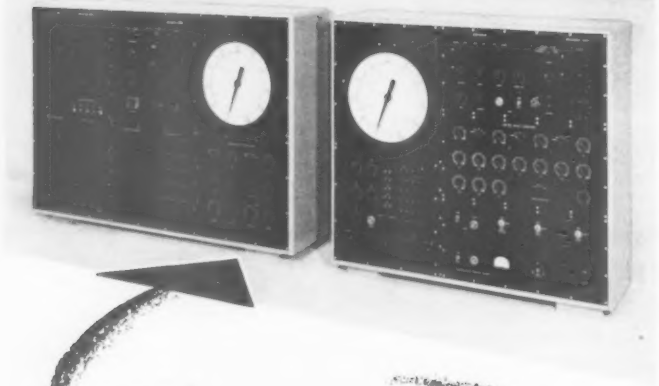
* Coffield & Guthrie 1-A Boyd, W. T. Ritchie Sur. IPP 30 BOPD, 24°, pay 976 ft., TD 1,027 ft. Extension well to above discovery.

Continental Oil Co. 1 Emma Hill, Jose y Aguilera Sur., A-2. Dry. TD 10,620 ft.

Leon County: Gate City Development Co. 1 Sam Bain, Wm. Webber Sur. Dry. TD 6,725 ft.

Van Zandt County: J & R Construction Co. 1 R. E. Herrin, Wm. Droddy Sur., A-200. Dry. TD 5,953 ft., elev. 463 ft., sub-Clarksville 3,495 ft.

OIL FIELD POOL ANALYZER



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Coleman Instrument Company

716 SOUTH TROOST • TULSA, OKLAHOMA

WEST CENTRAL TEXAS

Brown County: Stafford Jones and George Steine 1-4 Ruth Starr Blake, Blk. 14, A. White Sur. Dry. TD 1,600 ft.

C. E. Joyce 1 J. E. Watkins, Sec. 11, BBB&C Sur. Dry. TD 926 ft.

* Sloan Wells 2 Otto Leatherwood, Blk. 18, Juan Delgado Sur. 789. IPP 64 BOPD, 42°, pay 1,190 ft. TD 1,212 ft.

Callahan County: Miller Bros. 1 Mrs. Clara Holt, 66-14-T&P. Dry. TD 1,830 ft.

* Schkade Bros. Drilling Co. 2-B Clemmer, 64-14-T&P. IP 70 BOPD, 24/64-in., 40°, pay 1,603 ft. TD 1,609 ft.

W. T. Wagley 1 Lynn Williams, Sec. 2046, TE&L Sur. Dry. TD 545 ft.

Coleman County: Bay Petroleum Co. 2 J. L. Keese, 703-56-Burnett CSL. Dry. TD 3,151 ft.

B. H. Nolen and J. F. Lane 1 J. W. Brown Estate, Sec. 303, Blk. 4, Wm. W. Bomar Sur. Dry. TD 3,450 ft.

Western Petroleum Co. 1 Ray McKinney, Sec. 137, L. C. Spikes Sur. Dry. TD 3,868 ft., elev. 1,943 ft., Gray sand 3,861 ft.

Haskell County: Sojourner Drilling Co. 1 S. B. Young, Sec. 68, Blk. 68, A. King Sur. Dry. TD 5,254 ft.

Jones County: W. D. Brookover 1 J. W. Sedberry, 2-15-T&P. Dry. TD 2,460 ft.

T. M. Evans 1 W. J. Glenn, Sec. 15, BBB&C. Dry. TD 2,726 ft., elev. 1,620 ft., King 2,451 ft.

J. J. Lynn 1 M. Claburne, Sec. 25, Orphan Asylum Lands. Dry. TD 2,907 ft.

J. J. Lynn 1 Ekdahl, 18-3-H&TC. Dry. TD 3,752 ft.

Onyx Oil Co. 1 T. J. Lovvorn, 14-4-H&TC. Dry. TD 2,800 ft.

J. B. Schick 1 Lewis E. Austin, 44-1-BBB&C. Dry. TD 3,819 ft., elev. 1,694 ft., Gunsight 2,812 ft.

Yeatman Drilling Co. 1 Taylor Owens and Ruby Jones, Sec. 19, Orphan Asylum Lands. Dry. TD 3,396 ft., elev. 1,695 ft., reef 3,246 ft.

Parker County: T. W. Loffland 1 Chester Farris, J. Witcher Sur., A-1644. Dry. TD 5,280 ft., elev. 900 ft., conglomerate 5,182 ft.

Shackelford County: Ungren & Frazier 12 Elma Jackson, 96-12-T&P. Dry. TD 1,265 ft.

Stephens County: General Machine & Tool Co. 1 S. L. Harris, 37-6-T&P. Dry. TD 1,878 ft.

* Stonewall County: Texas Pacific Coal & Oil Co. 1 T. A. Upshaw, 82-D-H&TC. IP 203 BOPD, 18/64-in., 41°, pay 6,006-21 ft., TD 6,304 ft.

* Taylor County: R. G. McMurrey 1 A. C. McMillon, G. Hancock Sur. 430. IP 170.6 BOPD, 16/64-in., 39°, Gardner sand 3,950 ft., TD 3,972 ft.

Throckmorton County: Ada Oil Co. 1 Ada Davis Montgomery, Sec. 278, BBB&C Sur. Dry. TD 4,426 ft.

NORTH TEXAS

Archer County: Archer Drilling & Production Co. 1 L. M. Haytor, Sec. 1598, TE&L. Dry. TD 1,342 ft.

Hayden Farmer and D. R. Criswell 1 Benson Estate, Sec. 1398, TE&L. Dry. TD 945 ft.

* Clay County: L. T. Burns 1 J. Alcorn, 2-A381-T&NO. IP 252 BOPD, 14/64-in., Simpson limestone 6,192 ft. TD 6,214 ft. New field, 1½ miles NW East Henrietta field.

* Cooke County: Sussex Oil Co. 2 Dennison, Z. Whitesides Sur., A-1091. IPP 134 BOPD, 40°, top pay sand 2,148 ft. TD 2,452 ft.

Tri-Mark Oil Co. 1 T. F. Young, J. Bolin Sur. Dry. TD 3,021 ft.

Trumter Petroleum Corp. 1 Joe B. Cowling,

Chas. DeMorse Sur., A-332. Dry. TD 1,575 ft.

Foard County: Bay Petroleum Co. 1 Walter E. Ramsey, 418-A-H&TC. Dry. TD 4,010 ft.

Jack County: M. E. Andrews and American Drilling Co. 1-A Dodson, G. W. Stell Sur., A-529. Dry. TD 1,972 ft.

Ralph Harper 1 Cherryhomes, A. Parks Sur., A-460. Dry. TD 5,831 ft.

* Needl & Hood Drilling Co. 10 Prideaux "A," SPRR Sur., A-577. IP 215 BOPD, 10/64-in., 41°, pay sand 3,622 ft. TD 3,648 ft.

* W. T. Waggoner Estate 1 J. H. McCoy, N. B. Overby Sur., A-452. IP 81 BOPD, 6/64-in., 42°, pay 3,090-98 ft. TD 3,500 ft.

Young County: C. B. Christie 2 F. M. Cullers, Young CSL, A-1284. Dry. TD 3,654 ft.

R. W. Darden 1 J. R. Barnett, Blk. 186, TE&L Sur. Dry. TD 1,062 ft.

C. J. Simpson Drilling Co. 1 Stokes, Rebecca McGowan Sur., A-182. Dry. TD 3,542 ft.

* Timberlake & Scott 1 S. C. Shanafelt, J. P. Adams Sur., A-3162. IP 150 BOPD, ½-in., 41°, Strawn sand 3,371-80 ft. TD 3,380 ft.

WEST TEXAS

Andrews County: Neville G. Penrose, Inc. 1 Fisher, 8-A36-PSL. Dry. TD 4,534 ft.

* Borden County: Rowan Drilling Co. 1 L. I. Long, 37-30-T4N-T&P. IP 80 BOPD, 9/64-in., 44°, Mississippian 8,502 ft., TD 8,606 ft.

* Howard County: Pan American Oil Co. 1 O. H. Petty, 44-32-T&P. IP 521 BOPD, ¾-in., 46°, reef 8,102 ft., elev. 2,761 ft., top reef 8,104 ft. TD 8,233 ft.

Loving County: Magnolia Petroleum Co. 1 State, 29868, 4-19-University. Dry. TD 5,325 ft., elev. 2,749 ft., Delaware sand 4,917 ft.

Motley County: Humble Oil & Refining Co. 1 Matador Land & Cattle Co., Sec. 22, T. G. McNutt Sur., 4 mi. SW Matador. Dry. TD 10,596 ft., elev. 2,762 ft., Wolfcamp 4,675 ft., Canyon sand 7,772 ft., Mississippian 9,946 ft.

* Runnels County: Inca Drilling Co. 1 W. H. Cole, Hardeman Sur. IP 336 BOPD, 12/64-in., pay 3,666-78 ft. TD 4,180 ft.

Schleicher County: C. L. Norsworthy 2 R. F. Spencer, 49-A-J. H. Gibson Sur. Dry. TD 6,510 ft., elev. 2,364 ft., Ellenburger 5,670 ft.

Scurry County: Louisiana Land & Exploration Co. 1 Edward L. Howell, 70-2-H&TC. Dry. TD 7,315 ft., elev. 2,237 ft., Ellenburger 7,188 ft.

Sutton County: Ray Morris Drilling Co. 1-A Arthur Stuart, 68-7-TW&NG. Dry. TD 4,325 ft., Strawn 4,143 ft.

Tom Green County: John Odstricil 1 E. D. Jones, J. C. Helbe Sur. 758. Dry. TD 422 ft.

* Taylor Oil & Gas Co. 1-B George Foster Rust, 11-A-H&GN. IPP 25.7 BOPD, 36°, Canyon lime 4,530 ft. TD 4,689 ft. New pay.

* Taylor Oil & Gas Co. 3-A Rust, Sec. 3, Lucinda Byfield Sur. 3. IPP 45 BOPD, 34°, Strawn 4,513 ft. TD 4,775 ft. Discovery.

SOUTHEAST NEW MEXICO

Lea County: Emperor Oil Co. 1 State, 5-22s-23e. Dry. TD 3,740 ft.

ILLINOIS

Coles County: E. P. Spicer 1 Shields, NE SE SW 28-14n-14w. Dry. TD 300 ft.

Jefferson County: F. B. Cline 1 Nellott, NE SE NE 1-2s-1e. Dry. TD 2,361 ft., St. Genevieve 2,224 ft.

Madison County: L. Suhre 2 Brant, CW½ NW NE 6-5n-6w. Dry. TD 610 ft.

L. Suhre 1 Brant, NE NE NW 6-5n-6w. Dry. TD 635 ft.

Montgomery County: E. L. Wirth 1 Richardson, SW SW SW 24-11n-5w. Dry. TD 1,972 ft., Osage 1,190 ft.

Ryan Oil Co. 1 W. Gray, SW NW NW 29-10n-2w. Dry. TD 3,120 ft., Trenton 3,034 ft.

Moultrie County: National Association 1 B. Smith, NE NE SW 21-12n-6e. Dry. TD 2,080 ft., St. Louis 2,044 ft.

Perry County: C. G. Hardin 1 Hammack, SE SW NE 23-4s-2w. Dry. TD 2,911 ft.

Shelby County: National Association 1 G. W. Dent, NW NW SW 21-12n-6e. Dry. TD 2,080 ft., St. Louis 2,044 ft.

White County: D. B. Lesh 1 Land, NE NW NE 5-6s-10e. Dry. TD 3,167 ft., McClosky 3,153 ft.

INDIANA

Gibson County: B. Kidd 1 L. Bryant, NW NE SW 23-1s-11w. Dry. TD 3,210 ft., McClosky 2,141 ft.

H. Lovelace 1 Redman, SE NE SE 23-2s-12w. Dry. TD 2,840 ft., St. Genevieve 2,323 ft.

Knox County: Freeburg Oil Exploration Co. 1 Hislip, SE NE SE 23-5n-9w. Dry. TD 1,800 ft.

KENTUCKY

Muhlenberg County: Coy Oil Co. 1 E. Wells, SW NW SW 23-H-30. Dry. TD 1,195 ft.

R. W. Southard 2 Grace, NE SE NE 3-H-28. Dry. TD 2,195 ft.

WILDCAT COMPLETIONS

For results in coring

call on D&S

"KNOW-HOW"

PLUS Truco DIAMOND BITS

AND D&S CORE BARRELS

Drilling & Service

3031 Elm Street Dallas 1, Texas

OFFICE PHONE: Riverside 6811

NIGHT NUMBERS: ELmhurst 6335, Victor 3708

Other Offices-Services: Tyler, Texas — 2-2742; Odessa, Texas — 6-6774; Abilene, Texas — 2-2790; Victoria, Texas — 3264; Norman, Okla. — 4360; Shreveport, La. — 5-5474; Casper, Wyo. — 2-3761; Carmi, Ill. — 7799; Ft. Morgan, Colo. — 1143; Great Bend, Kans. — 7995

Distributor: Allied Services, Inc., Mt. Pleasant, Michigan Telephone: 29-861

Foreign: D. T. O'Connor, 500 Fifth Avenue, New York, N. Y. Petroleum Industry Consultants, C. A., Caracas, Venez. Denton-Spencer Co., Ltd., Calgary, Alberta, Canada

THE OIL AND GAS JOURNAL

"I got the same beef as Shorty had—but I'm gonna word it differently!"

NEW JELFLAKE HELPS CONTROL LOST CIRCULATION TWO WAYS

Graded Particle Size Gives Both Plugging and Plastering Effect on Formation Walls

New Jelflake® presents an improved method of sealing off "thief formations." By varying the size of the crinkled plastic sheets, Dowell has developed a much more effective material for stopping or preventing lost circulation.

Jelflake now contains particles that are graded in size from pinhead diameter to two inches in length. When added to drilling mud or cement slurry, the smaller particles actually penetrate and plug holes in the formation walls. The larger sheets plaster and seal, providing effective two-way control of lost circulation.

Pound for pound, Jelflake is the best lost circulation material you can buy at any price. The contents of one 25 pound bag can cover 500,000 square inches of formation surface.

"Keep Jelflake Handy." Several bags of Jelflake at the rig is your best insurance against lost circulation. Jelflake is sold everywhere. Ask your nearest mud distributor or Dowell station for the new, improved Jelflake.

DOWELL SERVICE

Acidizing · Jel-X · Electric Pilot · Perfo-Jet · Paraffin Solvents · Jelflake
Bulk Inhibited Acid · Chemical Cleaning for Heat Exchange Equipment

DOWELL INCORPORATED · TULSA 1, OKLAHOMA
A Subsidiary of The Dow Chemical Company

"First in Oilfield Acidizing . . . Since 1932"

Look to **DOWELL**
FOR OIL INDUSTRY CHEMICAL SERVICE

WILDCAT COMPLETIONS

Ohio County: Reat Day 7 Sharp, SE NE SE 23-N-31. Dry. TD 838 ft.

Union County: Eakle & Holler 1 Union County Airport, SE SW NW 13-M-19. Dry. TD 2,375 ft., McClosky 2,290 ft.

MICHIGAN

Bay County: C. W. Collin 1 New York Central, W½ NW 30-17n-5e. Dry. TD 2,842 ft. in Dundee.

Jackson County: E. Edwin Brehm 2 Reed, SW SE SW 18-4s-1w. Dry. TD 1,555 ft. in Traverse.

Kent County: Augie Busk & Carl Grimes 1 Miller et al, NW NE SE 24-9n-11w. Dry. TD 2,259 ft. in Traverse.

Newaygo County: John F. Melvin 1 Bragton, NE SE NE 19-12n-13w. Dry. TD 2,257 ft. in Traverse.

OHIO

Holmes County: Mid East Oil Co. 1 H. E. Miller, Lot 2, Berlin Township. Dry. TD 8,988 ft., in Clinton sand.

Lawrence County: Ashland Refining Co. 1 George Hartwig, Sec. 14, Lawrence Township. Dry. TD 3,459 ft., in Clinton sand.

Vinton County: Frank O'Mara et al. 1 New York Coal Co., Fr. 32, Vinton Township. Dry. TD 3,133 ft., in Clinton sand.

WEST VIRGINIA

Webster County, Glade district: Gregory Gas Co. 1 Gregory. IP 660 M.c.f. of gas natural, rock pressure 325 psi. in 48 hours. TD 1,499 ft.

FLORIDA

Bay County: A. R. Temple 1 Moore, C NW SE 27-1s-15w. Dry. TD 5,021 ft. in Tuscaloosa. Elev. 60 ft., marine Tuscaloosa 4,380 ft., Massive 4,710 ft.

Santa Rosa County: Sunnyland Contracting Co. 1 Nicholas, C NW NW 15-5n-29w. Dry. TD 6,992 ft. in lower Cretaceous. Elev. 190 ft., Wilcox 1,635 ft., Midway 2,920 ft., Chalk 3,710 ft., Eagle Ford 5,634 ft., marine Tuscaloosa 6,305 ft., Massive 6,724 ft., lower Cretaceous 6,965 ft.

MISSISSIPPI

Jefferson County: J. F. Crow Well Service Co. et al 1 Geoghegan, 50-8n-1e. Dry. TD 6,527 ft. in Wilcox. Elev. 324 ft., Wilcox 4,030 ft., base Big Shale 5,417 ft., Artman 5,737 ft.

Jones County: Petersen Drilling Co. et al 1 U.S.A.-J. G. Frazier estate, C SE SE 17-7n-10w. Dry. TD 8,546 ft. in Tuscaloosa. Elev. 285 ft., Wilcox 2,305 ft., Tuscaloosa 7,673 ft.

SOUTH LOUISIANA

* Calcasieu Parish: Louis J. Roussel 3 Haggart, 11-9s-7w. IP 2,360 M.c.f. daily and 275 BCPD, 10/64-in., 50.8°, casing perforations 11,150-180 ft. TD 11,222 ft. New pay in Iowa field.

Iberia Parish: Gulf Refining Co. 1 Spiller et al, 32-12s-11e. Dry. TD 11,512 ft.

Plaquemines Parish: Richardson & Bass 1 State, Lease 2114, 2-18s-16e. Dry. TD 11,547 ft.

Gulf Refining Co. 1 State, Lease 1905 in Coquilla Bay, Township 19s-18e. Dry. TD 12,500 ft.

* Pointe Coupee Parish: The Texas Co. 1 Wilbert, 34-6s-7e (Sherburne area). IP 146 BOPD, X-30 choke, 38°, casing perforations 8,850-55 ft. TD 11,095 ft. New field (Bayou Sherman).

St. Landry Parish: Circle Drilling Co. 1 Ariel Savoie, 46-6s-1e, 1½ miles southwest Savoy field. Dry. TD 10,466 ft.

* Terrebonne Parish: Shell Oil Co. 1 State, Lease 2077, State Tract 4965, offshore from USC & GS Station "Plumb." IP 2,944 M.c.f. daily and 38 BCPD, 13/64-in., 57°, casing perforations 7,540-49 ft. TD 12,750 ft. New field.

NORTH LOUISIANA

Catahoula Parish: H. D. Hunt 1 International Paper Co., 27-10n-6e. Dry. TD 5,301 ft. Wilcox 2,896 ft.

LaSalle Parish: Carter Oil Co. 1 Louisiana Central Lumber Co., 100 ft. N and E SWc 32-10n-2e. Dry. TD 3,000 ft.

ARKANSAS

Woodruff County: Carter Oil Co. 9 Core Test, 48 ft. E and 645 ft. S of NW SW NW 31-6n-3w. Dry. TD 1,540 ft.

Carter Oil Co. 10 Core Test, 80 ft. N and 48 ft. W SEc 12-5n-2w. Dry. TD 2,560 ft.

OKLAHOMA

Carter County: Jones Oil Co. 1 Segraves, SW SW SW 14-4s-2w. Dry. TD 4,819 ft.

*Garvin County: M. P. Stewart et al. 4 King, SW SW NW 27-1n-1e. IPP 4 BOPD, 935-1,172 ft. TD 1,351 ft.

Grant County: Mid-Continent Petroleum Corp. 1 Turek, NW NW SW 32-28n-4w. Dry. TD 5,464 ft. second Wilcox 5,440 ft.

Jackson County: Falcon Seaboard Drilling Co. 1 Braker, SW SW SW 33-1s-23w. Dry. TD 5,510 ft. Canyon lime 5,402 ft.

Kay County: Champlin Refining Co. 1 Henry Lambring, NW NW NE 17-27n-1e. Dry. TD 4,130 ft.

*Kingfisher County: Trigg Drilling Co. 1 Porter, NW NE NE 21-17n-7w. IPF 484 BOPD, 5,948 M.c.f. of gas daily, Misener 8,051-63 ft. TD 8,068 ft. (New pay at Southwest Dover pool.)

Latimer County: R. M. Akers and Wabash Drilling Co. 1 Gray, C E½ NE 17-5n-19e. Dry. TD 3,925 ft. Shaly lime 3,410-86 ft.

Lincoln County: A. A. Cameron 1 Pospisil heirs, NE NE SE 5-12n-6e. Dry. TD 4,675 ft.

(Continued on page 202)

This announcement is neither an offer to sell nor a solicitation of an offer to buy these securities. The offer is made only by the Prospectus.

$10,000,000

Kerr-McGee Oil Industries, Inc.

4½% Convertible Subordinated Debentures

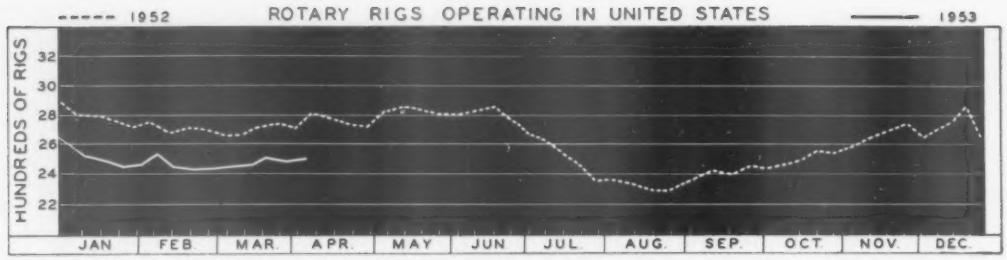
Dated April 1, 1953 Due April 1, 1968

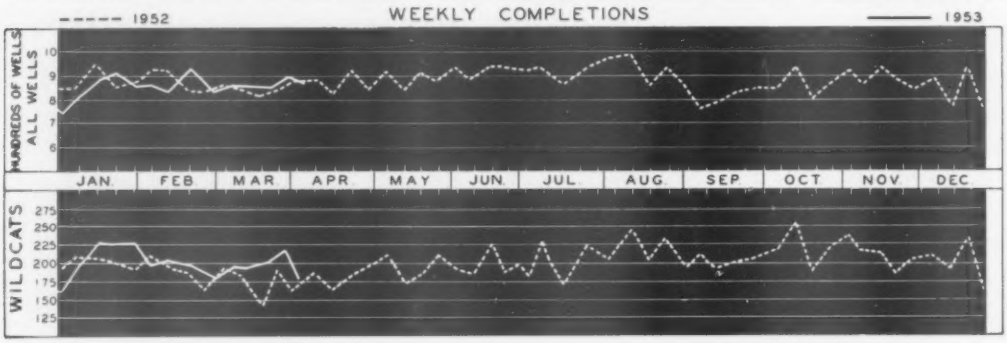
Price 100% and Accrued Interest

Copies of the Prospectus may be obtained in any State only from such of the several Underwriters, including the undersigned, as may lawfully offer these securities in such State.

LEHMAN BROTHERS STRAUS, BLOSSER & McDOWELL

April 2, 1953





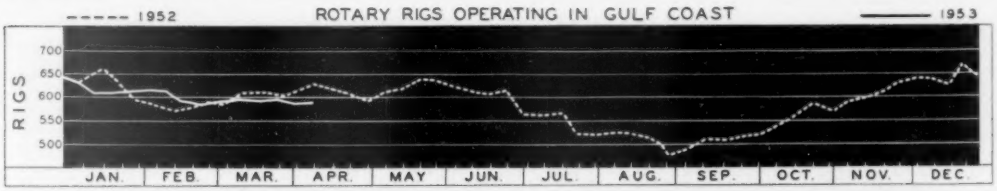
CURRENT STATISTICS

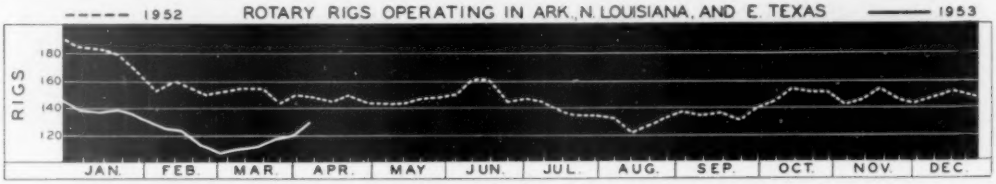
EXPLORATION

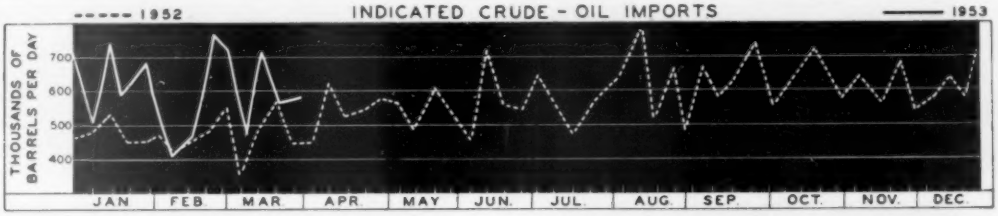
WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 4, 1953

	Total of all wells					Apr. 3		Wildcat completions and discoveries					Cumulative total, 1953				
	Comp.	Oil	Gas	Dry	Footage	1953	1952	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	15	7	0	*8	20,950	171	173	0	0	0	0	0	0	0	0	0	0
Pennsylvania	35	17	3	†15	58,250	426	421	0	0	0	0	0	0	0	3	6	9
West Virginia	11	0	9	2	25,106	136	163	0	0	1	0	1	0	0	2	1	3
Ohio	22	6	4	‡12	50,091	246	233	0	0	0	3	3	1	0	0	8	9
Indiana	29	14	0	15	51,547	305	285	0	0	0	3	3	6	0	1	67	74
Kentucky	24	4	5	15	41,321	263	329	0	0	0	4	4	4	0	3	49	56
Illinois	32	12	0	20	75,874	443	378	0	0	0	10	10	1	0	0	88	89
Michigan	11	5	1	5	31,741	141	156	0	0	0	4	4	6	0	1	55	62
Kansas	95	57	10	‡28	316,403	1,174	1,249	3	0	0	9	12	28	0	11	185	224
Nebraska	8	4	0	4	40,939	68	63	0	0	0	4	4	5	0	0	29	34
Oklahoma	143	86	4	§53	518,649	1,732	1,589	3	0	0	11	14	23	3	6	158	190
Texas	295	163	21	111	1,383,712	4,228	4,792	17	1	1	69	88	233	19	53	1,054	1,359
North Central (Dist. 7-B & 9)	104	58	0	46	352,664	1,482	1,501	9	0	0	29	38	125	0	5	431	561
West (Dist. 7-C & 8)	58	46	0	12	332,370	918	1,480	5	0	0	7	12	42	2	2	160	206
Panhandle (Dist. 10)	33	18	12	3	102,453	217	189	0	0	0	0	0	0	2	0	7	9
Eastern (Dist. 5 & 6)	13	6	0	7	70,286	209	230	2	0	0	5	7	7	1	1	69	78
Gulf Coast (Dist. 2 & 3)	43	14	6	23	290,791	654	713	1	1	1	14	17	34	4	27	163	228
Southwest (Dist. 1 & 4)	44	21	3	20	235,148	748	679	0	0	0	14	14	25	10	18	224	277
Louisiana	37	20	7	10	297,569	634	594	1	0	2	6	9	17	2	7	90	116
Northern	13	6	4	3	55,940	264	317	0	0	0	2	2	1	0	0	33	34
Southern	24	14	3	7	241,629	370	277	1	0	2	4	7	16	2	7	57	82
Arkansas	12	5	0	7	45,915	117	98	0	0	0	2	2	5	0	0	24	29
Mississippi	4	2	0	2	26,472	89	113	0	0	0	2	2	6	0	1	43	50
Southeastern States	2	0	0	2	12,013	38	15	0	0	0	2	2	1	0	0	30	31
Montana	6	2	0	4	35,879	93	42	0	0	0	2	2	1	0	0	26	27
Wyoming	8	7	0	1	45,387	139	152	1	0	0	0	1	2	0	0	28	30
Colorado	8	4	1	3	42,963	118	103	1	0	0	3	4	3	0	2	68	73
Utah	1	1	0	0	5,783	23	23	0	0	0	0	0	1	0	0	14	15
New Mexico	20	10	5	5	95,291	328	242	0	0	0	1	1	5	0	4	37	46
California	44	33	0	11	149,306	627	666	1	0	0	10	11	15	0	2	145	162
North Dakota	8	8	0	0	67,985	64	5	0	0	0	0	0	0	0	0	12	12
Miscellaneous (S. D.)	1	0	0	1	6,325	11	17	0	0	0	1	1	0	0	0	9	9
Total United States	871	467	70	334	3,445,471	11,614	11,901	27	1	4	146	178	363	24	96	2,226	2,709
Total previous week	900	469	72	359	3,734,705			32	1	11	174	218	336	23	92	2,080	2,531
Total April 5, 1952	891	492	55	344	3,719,492			33	3	3	149	188	387	29	64	2,063	2,543

Service wells included: *8, †13, ‡1, §3.



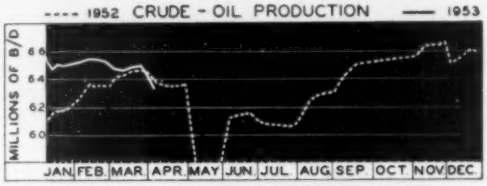


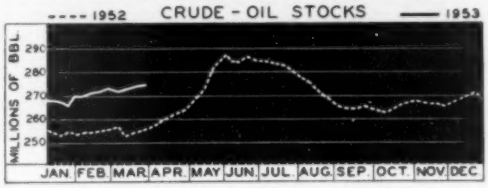


DAILY AVERAGE PRODUCTION FOR WEEK

	April 4			Mar. 28
	Crude oil	Lease condensate	Total	total
Alabama	4,400		4,400	4,500
Arkansas	77,050	650	77,700	77,200
California	991,200		991,200	992,600
Colorado	91,200		91,200	93,000
Eastern	57,000		57,000	56,000
Florida	1,450		1,450	1,475
Illinois	163,900		163,900	163,300
Indiana	36,300		36,300	33,500
Kansas	323,700		323,700	341,100
Kentucky	29,600		29,600	29,300
Louisiana	659,350	41,700	701,050	728,225
North	113,400	2,700	116,100	115,400
South	545,950	39,000	584,950	612,825
Michigan	33,200		33,200	34,500
Mississippi	92,550	4,750	97,300	97,100
Montana	32,000		32,000	32,000
Nebraska	12,500		12,500	12,500
New Mexico	182,800	650	183,450	180,875
Oklahoma	541,100		541,100	540,200
Texas	2,688,100	46,700	2,734,800	2,852,600
Dist. 1	35,350	250	35,600	37,050
Dist. 2	148,050	5,900	153,950	157,675
Dist. 3	446,050	24,000	470,050	484,775
Dist. 4	248,125	5,800	253,925	260,275
Dist. 5	47,350	450	47,800	49,000
Dist. 6	120,450	5,700	126,150	128,725
East Texas field	251,000		251,000	247,000
Dist. 7-B	103,800	75	103,875	105,050
Dist. 7-C	152,500	3,500	156,000	189,925
Dist. 8	889,175	300	889,475	931,675
Dist. 9	173,875	700	174,575	188,700
Dist. 10	72,375	25	72,400	72,750
Utah	4,900		4,900	5,000
Wyoming	208,800		208,800	209,500
North Dakota	13,300		13,300	13,000
Total U. S.	6,244,400	94,450	6,338,850	6,497,475
Change from previous week, down			158,625	
Canada	164,900		164,900	164,900
Total U. S. production January 1-April 14			610,449,775 bbl.	
Same period last year (crude plus cond.)			*594,682,200 bbl.	

*Includes 9,162,160 bbl. condensate.



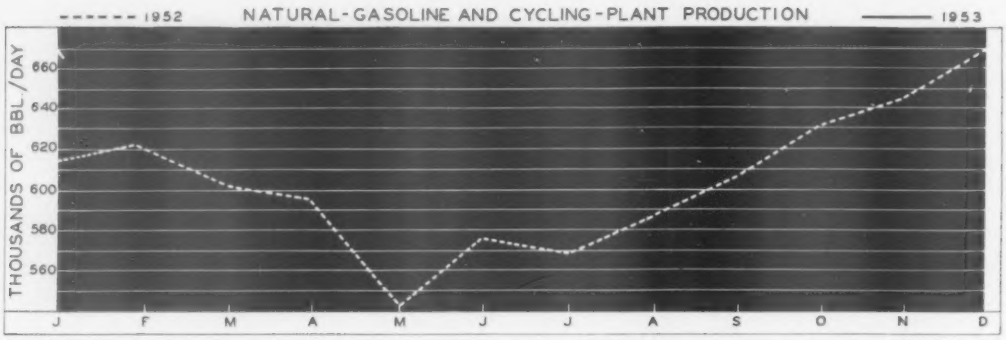


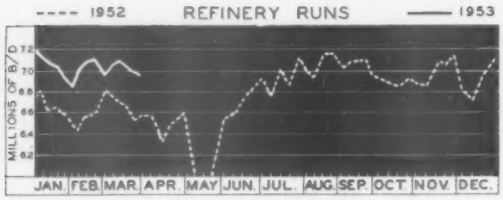
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

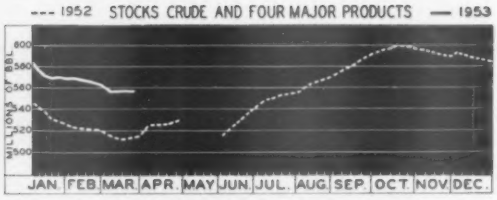
(Thousands of barrels)

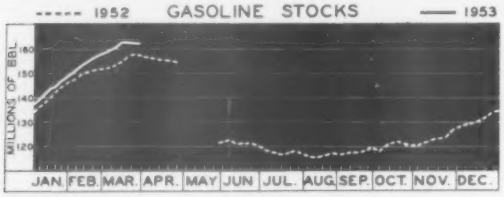
	Mar. 28, '53	Mar. 21, '53	Mar. 29, '52
Pennsylvania Grade	2,422	2,378	2,274
Other Appalachian	1,867	1,751	2,057
Illinois, Indiana, Michigan	10,494	10,493	11,556
Arkansas	3,083	2,974	3,057
Louisiana	17,288	17,075	14,442
North	3,164	3,224	3,083
Gulf	14,124	13,851	11,359
Mississippi	3,950	3,854	3,506
New Mexico	7,271	7,168	7,534
Oklahoma and Kansas	36,246	36,288	38,035
Texas	135,346	135,934	123,726
East Texas proper	11,584	11,426	11,413
West Texas	64,764	65,165	55,191
Texas Gulf	25,547	25,978	26,062
Other Texas	33,451	33,365	31,060
Rocky Mountain	16,490	16,124	14,275
California	33,520	32,780	30,194
Foreign	7,001	7,661	6,005
Total	274,978	274,480	256,661

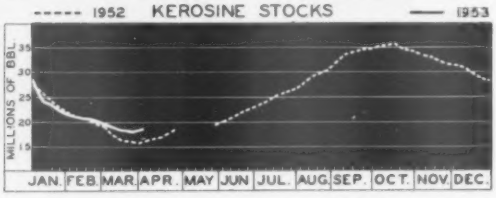
*Bureau of Mines.

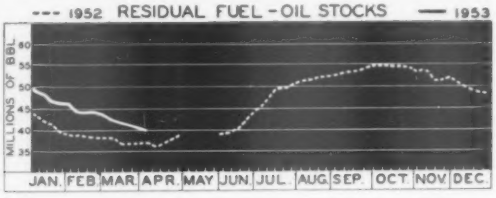










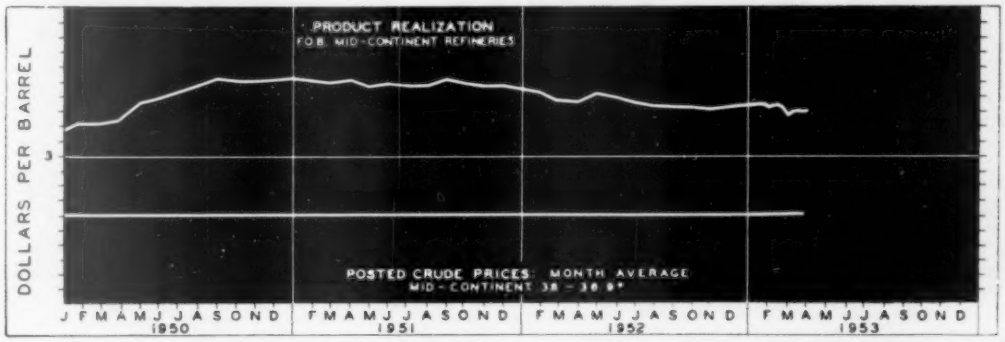


A.P.I. REFINERY REPORT, APRIL 4

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, April 1952 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,020	387.7	38.7	267.8	200.0	35,125	7,986	19,547	9,178	966	384.1	45.2	207.3	237.5
Appalachian:														
District 1	106	43.0	7.4	21.6	15.1	4,011	423	982	449	97	39.3	5.7	11.7	9.9
District 2	89	38.6	6.3	15.6	13.4	1,788	283	417	137	58	33.1	3.3	10.0	10.3
Ind., Ill., Ky.	1,208	648.4	76.6	207.6	154.3	37,260	3,629	9,035	3,511	1,201	625.8	66.8	215.6	174.3
Okla., Kans., Mo.	568	332.9	14.1	123.6	58.0	18,422	1,174	6,496	1,192	487	269.5	16.5	102.1	55.2
Inland Texas	246	144.9	13.0	35.3	31.9	6,341	287	1,079	894	251	166.6	14.1	38.5	38.5
Texas Gulf Coast	1,811	763.0	150.3	424.3	249.3	22,400	2,465	7,078	6,207	1,628	707.4	139.4	390.2	265.2
La. Gulf Coast	498	256.8	43.8	150.8	53.9	8,110	1,448	3,473	1,449	504	241.2	55.8	125.4	60.9
N. La. and Ark.	89	33.6	9.0	18.6	7.9	3,417	395	1,134	83	81	31.7	5.9	19.6	6.6
Rocky Mountain:														
New Mexico	19	11.1		2.7	3.7	141		35	31	18	10.6	0.5	2.9	4.0
Other Rocky Mtn.	204	98.0	1.9	44.4	36.3	6,878	303	1,693	899	175	83.3	5.7	36.3	35.6
California	1,107	442.1	11.0	155.1	403.8	18,356	367	8,754	15,968	969	402.7	7.0	152.2	355.4
April 4, 1953	6,965	3,200.1	372.1	1,467.4	1,227.6	162,249	18,760	59,723	39,998	6,435	2,995.3	365.9	1,311.8	1,253.4
March 28, 1953	7,000	3,237.0	344.4	1,451.3	1,266.1	162,878	18,417	59,757	41,002					
April 5, 1952	6,557	3,058.6	371.1	1,347.7	1,266.4	158,431	16,533	48,827	36,565					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
DOLLARS PER BARREL
3
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 36.8°
J F M A M J J A S O N D
1950
F M A M J J A S O N D
1951
F M A M J J A S O N D
1952
F M A M J J A S O N D
1953

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate and fuel oil. Realization averaged $3.30 for week ended March 28, $3.29 for previous week, and $3.37 for March 1952. The above trend information is based on volumes and current prices and therefore does not reflect changes in operating costs.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of April 8, 1953. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10⅛-10½	12-12.75	10½-11
Premium gasoline, 86-88 octane	11¾-11½	13.125-14	11¾-12
42-44 w.w. kerosine	8⅜-8¾	10.40-10.65	9
No. 2 straw fuel oil	7⅜-7¾	9.40-9.65	8
No. 6 residual	$0.80-1.00	$2.00-2.25	$1.60-1.70

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5½	5	5¾
Grade 18-55	6.60	6.10	6.35

LUBRICATING OILS
South Texas

200 vis., No. 2-3 neutral	12-13
750 vis., No. 3-4 neutral	15-16
2,000 No. 5-6 neutral	17-18

LUBRICATING OILS
Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	21-22
200 vis., No. 3 neutral, 0-10 pp.	12-13

Western Pennsylvania

145-155 vis., 10 p.t. bright stock	26.5
180 vis., 0 p.t. neutral	29.5

WAX
Mid-Continent

132-134 A.M.P.	5.5

ESSO STANDARD OIL CO. raised its residual fuel prices by 10 cents a barrel, effective April 11. The new prices are for both East Coast and Gulf Coast terminals and include all methods of delivery. Prices for blended residuals were increased by proportionate amounts.

Esso Export Corp. announced an increase of 10 cents a barrel in prices for cargo shipments of residual from Aruba. This brings the Aruba price to $1.60, effective April 2. The Aruba quotations are normally competitive with the low of the Gulf Coast market.

As late as the middle of June last year, No. 6 residual in New York Harbor ranged from $2.45 to $2.60 a barrel for barge delivery. At the same time the Gulf Coast market was $1.75-$1.90 for cargo lots. By the end of June, the lows were off to $2.35 at New York and $1.70 on the Gulf Coast. The Gulf Coast had lost another 10 cents by the middle of July.

Further softening of the market cut the low of quotations to $1.50 on the Gulf Coast and $2.10 in New York Harbor by the first week of August. These prices held until Esso cut postings on the East Coast by an average of about 10 cents a barrel on January 5, 1953.

At the time of the January reduction on the East Coast, tanker markets were soft. For the week of the price drop, spot rates were reported at Maritime Commission base minus 35 per cent. Since rates are now about MC minus 30 per cent and at a season of the year when tanker markets tend to soften, transportation cost was not a major factor in the current increase.

While the market is still abnormally low both on the Gulf Coast and on the East Coast, the recent slight strengthening of these markets was based on lower refinery runs on the Gulf Coast and reduced imports on the East Coast. The failure of either will put pressure on the new prices in both areas.

CRUDE PRICES
GRAVITY SCHEDULE

	Signal Hill, Calif‡	Okla. homa, Kansas	Gulf Coast Tex.*	West Tex.†
14-14.9	$1.87	...	...	...
15-15.9	1.93	...	...	...
16-16.9	1.99	...	...	...
17-17.9	2.05	...	...	...
18-18.9	2.11	...	...	...
19-19.9	2.18	...	...	...
20-20.9	2.24	$2.25	...	$2.12
21-21.9	2.30	2.27	...	2.14
22-22.9	2.37	2.29	...	2.16
23-23.9	2.45	2.31	...	2.18
24-24.9	2.53	2.33	$2.56	2.20
25-25.9	2.61	2.35	2.58	2.22
26-26.9	2.69	2.37	2.60	2.24
27-27.9	2.76	2.39	2.62	2.26
28-28.9	2.83	2.41	2.64	2.28
29-29.9	2.91	2.43	2.66	2.30
30-30.9	2.97	2.45	2.68	2.32
31-31.9	3.04	2.47	2.70	2.34
32-32.9	3.12	2.49	2.72	2.36
33-33.9	...	2.51	2.74	2.38
34-34.9	...	2.53	2.76	2.40
35-35.9	...	2.55	2.78	2.42
36-36.9	...	2.57	2.80	2.44
37-37.9	...	2.59	2.82	2.46
38-38.9	...	2.61	2.84	2.48
39-39.9	...	2.63	2.86	2.50
40 and above	...	2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico.

Last general price change represented a 50-cent increase, effective December 6, 1947.

‡Standard Oil Co. of California.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

Louisiana:	
Beauregard Parish	$2.60
Cotton Valley (distillate)	2.85
Cotton Valley (crude)	2.70
Texas:	
East Texas	2.65
Pecos County (Yates)	2.35
Conroe	2.83
Van	2.48
Pennsylvania Grade:	
Bradford	4.40
Southwest Pennsylvania	3.97
West Virginia	3.91
Illinois Basin	2.77

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KEYSTONE Spudder trailer mounted truck and tools. Located Washington County, Oklahoma. $1800.00. Working on well, ready to move. Box G-384, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 2—New B. J. Multiplex 6 x 8 x 10 pipe line pumps, 1000 Gal. @ 400 ft., maximum head 2000'. List $3468.00 each. Our Price $1250.00 each. Bender Oil Operations, P.O. Box 52, Bakersfield, California.

JOY 300 Drilling Rig butane powered, mounted on Brockaway 6x6 truck. 3500 feet 3½ inch drill pipe. Auxiliary mud pump and butane engine as separate unit. All tools and equipment included. This rig in first-class working condition and can be seen working now. Call or write Steele Brothers, Crete, Nebraska. Phone 127.

14 miles 6⅝" O.D., seamless, weight 18.97, Range 2. 11½ miles 4½" O.D., seamless, weight 8.64, Range 3. All above pipe laid in 1943, clean inside, all beveled for welding, cleaned outside, located Cushing and Cleveland, Oklahoma. Guaranteed A No. 1.

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FOR SALE: ZC 739 Fairbanks-Morse engines taken off for electrification purposes, and completely overhauled. Complete with clutch and sheave. Silvan Supply Company, Box 567, Drumright, Oklahoma.

FAILING 1500 heavy duty drill with 4½ x 6 pump, automatic pulldown, and mounted on International truck. Write P. O. Box 819, Longmont, Colo. Phone 1333.

TWO DOUBLE DRUM WILSON MOGUL SPUDDERS on steel skid, gasoline engine, butane heat exchanger, 60' single leg mast pole, dog house, electric plant, junk rack, tools. Practically new, excellent condition, ready to work. Located Grant Body and Equipment Company yard, Tulsa. Price $15,000.00 each. Phone 3-9191, Box 1896, Tulsa.

FOR SALE

Approximately 100 miles 6⅝" O.D. 18.97# Used Lapweld Line Pipe in single random lengths, plain ends beveled.
This pipe is cleaned, primed and beveled and is offered FOB Indiana Shipping Point. Subject to inspection and acceptance at location. Prices are reasonable, with special consideration to dealers.
We solicit your inquiries for all or part of this pipe, and for further information please write or call:

COMMERCIAL METALS COMPANY
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HUnter 4651

STANDARD PIPE SUPPLY COMPANY
P. O. Box 243, Houston, Texas
CHarter 6976

DAVIDSON PIPE COMPANY, INC.
2nd Avenue 50th St., Brooklyn 32, N. Y.
GEdney 9-6300

TEXAS PIPE & SUPPLY COMPANY
P. O. Box 1331, Houston, Texas
BLackstone 0101

EQUIPMENT FOR SALE

FORT WORTH, Model-D Spudder complete with International power unit, tools for 22" diameter holes, located near Los Alamos, New Mexico. Inventory furnished upon request. Texas Water Wells, Inc., 951 McCarty Drive, Houston, Texas.

WELL drilling equipment, new or used. Spudders, rotaries, core & shot hole drills, tools, pipe, bits, blocks, pump jacks, valves. Everything for well drilling and service. Fishing tools rented. Pressey & Son, Pueblo, Colo.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted. Immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

FOR SALE

Complete National 100 Rig including 3 PTD-6 Superior Diesel Engines with dual fuel equipment, 136' Lee C. Moore Mast with 8' substructure, 2 C-350 Ideal Power Pumps, Ideal Type 548 TC Traveling Block, Type R3 Swivel, and Type MS-20½ Rotary Table. Excellent condition, priced reasonable, located in Montana. Complete inventory upon request.

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FOUR used Pumping Units, complete less motors. Suitable for 3,500′ wells. Four used pumping units complete less power. Suitable 5,500′ wells. E. A. Kelly, Box 861, Oklahoma City. Jackson 5-6407.

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FOR SALE

Complete steam drilling rig with 5—350 lb. Broderick boilers, 144 ft. M and M Derrick, 11 ft. sub-structure, 23-9 Ideal draw works, 2 Ideal 20″ pumps, 548 TC traveling block, HS-20½ rotary table, M3 swivel, excellent condition. Complete inventory upon request. Located in Calif.

THE SUPERIOR OIL CO.
Los Angeles, California

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Twin Engine Beechcraft

EXECUTIVE TRANSPORT C-18-S . . . . fitted out for executive use and in excellent condition. Always hangared. Three Pratt & Whitney R-985 engines. Time since major engine overhaul: 62 hours, right engine; 687, left engine; no hours on spare engine. Airframe time since new 1692 hours, 675 hours since major overhaul. Hamilton Standard Constant Speed Propellers. New drag link landing gear modification done by Beechcraft factory. Pilot, co-pilot oxygen system. 24-volt electrical system. Full radio and instrument equipment. Interior luxurious and immaculate with passenger radio, razor outlet and folding desk. Two chairs, 3-place divan and private toilet in rear compartment. Exterior white top, dark blue trim, polished alum'num bottom and wings. Corporation owned and used.

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30,000′ used seamless pipe—12¾″ O.D.—⅜″ wall—51 lb. per foot—in lengths from 17′ to 40′—located in Indiana. Priced for immediate sale. Wire, write or phone.

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510 hp. at 360 r.p.m.—5 cylinder—14½x18 type ZDSB — non-reversing — vertical—4 cycle—cold starting—mechanical injection. Engine is totally enclosed. Complete with a 48″ 7 groove V-belt sheave and new spare parts. For heavy duty pumping, dredge service, power generation, textile and saw mills, mining, etc. EXCELLENT CONDITION. IMMEDIATE DELIVERY.

GM 3-71 DIESEL GEN. SET

30 kw. 2 cylinder 4½x5 diesel—radiator cooled—electric starting. Delco 3/60/440 generator — with switchgear. Skid mounted. Portable.

THE BOSTON METALS CO.
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FOR SALE: R. L. Dubbledrum Cardwell fully equipped. Oklahoma City, Oklahoma. Melrose 8-5108.

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FOR SALE: Failing heavy duty 1500-S long mast, long kelly, Buda powered. Fred E. Butler, Box 1832, Casper, Wyoming.

FOR SALE: Cardwell, model RL, Beam type cable tool drilling unit, At present in operation in West Central Kansas. Complete inventory and price furnished on request. K & A Drilling Co., Phone 448R or Box 497, Ellinwood, Kansas.

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at attractive prices

30,000 ft.—1″ Used Oil Well Tubing @ 12c ft.
10,000 ft.—1½″ Used SEAMLESS Tubing @ 20c ft.
50,000 ft.—2″ 4♯ and 4½♯ LW Used Tubing @ 18c ft. and up.
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All above located our yards at Butler, Pa.
5,500 ft.—7″ OD 23♯ SEAMLESS Casing Range 2 and 3. Located at Bakersfield, California.

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New at East Chicago, Indiana, 3 BS&B Catalytic Converters Complete, 4′ ID x 28′ Ser. ♯2856T1, 2 and 3, Shells ½″ thick ASTM-A 70 Flg. quality steel, Tube Sheets 10¼″ thick same steel, cover plates 7⅜″ thick ASTM-A 212 Fire Box quality. 48—⅝″ OD x 26′ x 3½″ Seamless Tubes A-106-39 Grade "B," Shell Design Pressure 60♯ PSIG., Test 90♯. Tubes and Heads 1100♯ PSIG., Test 1650♯. Full data and price on request.

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Electric Motors & Starters

General Electric Company electric motors and starters, motors in original crates. All new equipment, never used. Following inventory on hand in warehouse, Fort Worth, Texas:

1. Seven (7) 1 hp., Model 5B 203A13, type B. frame, 200 ♯203 Shunt Wound, 115 Volts, 1750 R P M, Enclosure Open, Continuous Duty. DC Electric Motors.
2. Six (6) CR-4052-ALL Cat. 6932902-G-11-hp. 1-1.5, Volts 115, Amp. 9.2-12.4 Starters.
3. One (1) CR-4052-A2L Cat. 6932903 G-5-hp., Volts 115, Amp. 40 Starter.

For full detailed information and price, CALL, WRITE or WIRE

Purchasing Department

Mid-Continent Supply Co.
Box 189 Fort Worth, Texas

EQUIPMENT FOR SALE

FOR SALE: One Barrel Type Ethyl Lead Plant. Hutex Oil & Refining Company, P. O. Box 2146, Houston, Texas.

FOR SALE: Mayhew ♯1000 Drilling Unit in good condition with auxiliary pump motor all mounted on 1½ ton Chevrolet Truck. Ready for immediate field operation. Will sell with 170 feet of pipe, with or without water truck. If interested write Box 336 or Call 1555-J, Monahans, Texas.

FOR SALE: 8—Shriver 42″x42″ cast iron Filter Presses, Plate & Frame type, 18, 27, and 54 chambers, 1″ cake; 15—Sperry 18″x18″ cast iron Filter Presses, 11 chambers; 2—♯12 Sweetland Filters for 36 leaves on 4″ centers. Immediate shipment. Attractively priced. Consolidated Products Co., Inc., 17-20 Park Row, New York 38, N. Y. BArclay 7-0600.

USED ROTARY, cable tools, and production equipment. E. A. Kelly, 3131 S.E. 29th Street, P. O. Box 861, Oklahoma City. Phone Jackson 56407.

FOR SALE—Model 5000 Franks Skid Type Rotary complete with 96 foot derrick; two 200 hp. Diesel Motors compounded; 7¼ x 12 Gardner-Denver Pump; with or without 5000 feet 4½″ Drill Pipe. Located Central Nebraska. Box G-415, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE

Gas Booster and Gasoline Plant complete. 300 h.p., 500♯ discharge. Engines rebuilt, Electric pumps, Tower and Gas Coolers. Fittings and instruments new. Storage tank and accumulators. Had less than 60 days operation. Terms to suit.

W. S. SMITH
205 Thompson Bldg. Tel. 2-5473
Tulsa, Oklahoma

FOR SALE

Wilson Mogul Draw Works—Pump Drive Two GK 145 Engines, 86,000.00. Wilson Atlas Draw Works—Pump Drive, Two LI 600 Cummings Diesel Engines, $24,500.00. Cardwell RL Draw Works, WAK Engine, Like New, $10,500.00. Wilson—Brewster—Ideco Core Units, $3,000.00 to $4,500.00.

Cecil Hilliard—Cardwell Representative
P. O. Box 20097—Houston 25, Texas

USED C-150 IDEAL MUD PUMP
MOUNTED ON SKIDS WITH SHEAVE
EXCELLENT CONDITION

Contact
Mountain Iron & Supply Company
714 Fourth National Bank Bldg.
Wichita, Kansas

FOR SALE

3 Type Ten Twin Bessemer Gas Engine Compressors. Will sell as is or completely repaired.

1 Clark 100 h.p. Gas Engine Driven Compressor in good condition. Will sell as is. Lots of parts for type X and Eight Bessemer Engines. Power Cylinders & Heads, Shafts, Compressor Cylinders, most sizes and pressures.

W. S. SMITH
205 Thompson Bldg. Tel. 2-5473
Tulsa, Oklahoma

FOR SALE

11 Case LAE—55 H.P. motors
8 Lufkin 31-C Pumping Units
2 Lufkin HB-31 Pumping Units
5 Ideco Pumping Units—Type D, 33 H.P.
2 Foote Bros. Pumping Units — Type DO-20, 50 H.P.
1 Foote Bros. Pumping Unit — Type SO-26, 40 H.P.
1 New Intermediate gear for Foote Bros. DO-20
1 New High Speed gear for Foote Bros. SO-26

Motors and units complete with sheaves, some with belts. Located in Powell field, Corsicana, Tex.

Contact S. L. BRASHEAR
Care of Olsan Bros., Inc.
Box 550
Corsicana, Tex. Phone 1133

EQUIPMENT FOR SALE

FORD F-6, 1950 with Leland Oilfield Bed and Tulsa winch, complete. Spencer Pipe Trailer with 9:00 Tires and Electric brakes. 1 set new Athey tracks. Midwest Pipeline Service, P. O. Box 8851, Kansas City 15, Mo. FE 2260.

1500' GOOD used 2 7/8" drill pipe. M. Mazzarino, Staunton, Ill.

FOR SALE: 1 Worthington 4" x 18", 4-5 chrome block, horizontal, duplex, double plunger, enclosed frame hot oil fitted power pump, driven by Worthington 12½ x 14" horizontal double acting steam engine, with some spare parts for engine. 1 Worthington 5¼" x 18", 4-6 chrome block, horizontal, duplex, double plunger, enclosed frame hot oil fitted power pump, with some spare parts; driven by Worthington 12½ x 14" horizontal, double acting steam engine, with some spare parts. Equipment second hand, in good condition; spare parts new. American Liberty Oil Company, Box 1011, Mt. Pleasant, Texas.

87' Lee C. Moore Cantilever Derrick located East Central Oklahoma. Drilled one well since complete overhaul by Lee C. Moore. 4½' substructure, steel floor, 4' drop wings. $8,000.00. Box G-329, The Oil and Gas Journal, Tulsa, Oklahoma.

USED EQUIPMENT for Sale: Shaffer & Regan Blowout Preventers, B.J. Hooks, Rotary Tables, Traveling Blocks & Mud Pumps. Used Drill Pipe, all Range 2, 3½" API FH w/5" OD Joints; 3½" API IF w/4¾" OD Joints; 4½" API FH w/Flash Weld & Conventional Joints. Phil A. Cornell, Box 5113, Farley Station, 4200 West Reno, Oklahoma City, Oklahoma. Phone WI 2-5660.

FOR SALE: 800 ft. 12½ Seamless Casing in number 1 shape. Archie Newland, Yates Center, Kansas. Telephone 232.

FOR SALE: 12 miles 4½ OD 10.79# 40' double random lengths, beveled line. S & S Pipe & Supply Company, P.O. Box 2513, Phone 50-9287, Tulsa, Oklahoma.

FOR SALE: Model R.L. 30-Drum Cardwell Spudder, Trailer Mounted, complete with all tailing-in tools. 7000 feet almost new 9 16-inch and 3¼-inch lines. Will sell with or without tools. For full description and inventory, write Box G-406, The Oil and Gas Journal, Tulsa, Oklahoma.

LARGE MODEL K Cardwell with SRK Waukesha Engine with 55', 8⅝ telescoping pole. Unit fully equipped with all tools and lines. All mounted on GMC 6 x 6. All ready to work. Price $9,000.00. J. L. Chew, Lyons, Kansas.

FOR SALE: Failing "1500" Holemaster powered by Chrysler industrial power unit, mounted on 1942 GMC truck. Rig complete with mud pump, 1000' of "N" rods, drill collar and core barrel, slips, elevators, subs, etc. Equipment showing very little use. 1—1942 GMC water truck, A-1 condition. Price $14,000.00. For inventory contact P.O. Box 409, Del Rio, Texas.

FOR SALE: 66 Wichita Drilling Rig. Complete tools, 6 cylinder Lersi Engine. Location, Mentone, Texas. Phone 1177 J, Pecos, Texas.

ROTARY CONTRACTORS—7" OD type "A" B-J casing elevator, rated 175 tons capacity, slips for 5" rotary drill pipe, liners for OWS pump 7" x 16" hard, No. 7 P pump—NEW MATERIALS special prices. PRINTY PIPE & SUPPLY, BOX 253, CUT BANK, MONT.

EQUIPMENT WANTED

WANTED: Three engine compound for Wilson Titan drawworks. Makin Drilling Company, Box 1628, Phone 3-3141, Hobbs, New Mexico.

WANTED: One Thrible Jack-knife and substructure. No Junk Wanted. Makin Drilling Company, Phone 3-3141, Hobbs, New Mexico.

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

ONE OR MORE complete Hyd-Robot Podbielniak low temperature distillation units wanted. Box G-417, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

DIVISION GEOPHYSICIST — Position open. Good salary. Require well qualified geophysicist, with geological education or training, and at least three years' experience in Permian Basin. Write:—Union Oil Company of California, 200 Wilkinson-Foster Building, Midland, Texas. Attention:—Mr. H. L. Swords.

GAS MEASUREMENT Engineer for Caracas, Venezuela. Supervises meter section, calculating procedures, chart clerk and various tests. Should have college degree and minimum of six years experience in gas measurement department of natural gas utility company. Liberal salary and living allowance. Give full details in reply to P. O. Box 2819, Dallas, Texas.

EXPLORATION GEOLOGISTS SOUTH AMERICA

Major oil company affiliated with Standard Oil Company (N.J.) has attractive staff positions available for qualified geologists. Assignments cover surface, sub-surface and/or development geology.

Write giving age, marital status, education, and details of experience.

Box 308-E

Radio City Station

New York 19, N. Y.

HELP WANTED

QUALIFIED Gas Accountant with field experience for work in Caracas, Venezuela, to audit and analyze charges, check billing rates, etc. College degree in business preferred. Give full details in reply to P. O. Box 2819, Dallas, Texas.

SUBSURFACE GEOLOGIST-MICRO-PALEONTOLOGIST

To work on deep wells in Saudi Arabia, making lithologic and faunal logs from cores and cuttings, interpreting electric logs, and working on field and regional stratigraphic studies. Salary dependent upon experience and qualifications.

Write giving personal history and work experience. Please include telephone number.

RECRUITING SUPERVISOR, BOX OGJ

ARABIAN-AMERICAN OIL CO.

505 Park Ave., New York 22, N. Y.

ESTIMATORS

Young engineers capable of mechanical estimating for construction of refineries, steam power and similar industrial projects. Must have some field experience.

Considerable weight given to ambition, intelligence, and interest in estimating and cost analysis.

BECHTEL CORPORATION

220 Bush Street

San Francisco, California

OIL REFINING AND GASOLINE PLANT SUPERINTENDENT

Required by

TEXAS GAS CORPORATION

Apply to

Russell M. Riggins, Pres. or **Hugh V. Miller, Vice Pres.**

Prudential Bldg., 17 Floor **Winnie, Texas**

Houston 25, Texas

PETROLEUM ENGINEERS WANTED

BY MAJOR OIL CO. IN VENEZUELA

ONE . . . with degree of CHEMICAL ENGINEER plus 1 - 2 years experience and training in Field Petroleum Engineering or Reservoir work.

ONE . . . with degree in PETROLEUM ENGINEERING plus 1 - 2 years field experience and training.

ONE . . . with degree of MECHANICAL ENGINEER plus 1 - 2 years training and experience in Field Petroleum Engineering or Equipment work.

AGE LIMIT TO 30 YEARS -- SINGLE PREFERRED

Base Salary To $500 — Depending on Experience & Qualifications

Write To: C. L. Laue, 26 Broadway, New York 4, New York

HELP WANTED

THE University of Tulsa has an opening for a qualified faculty member with masters or substantial experience. Reasonable salary and opportunity for consulting and research. If interested contact Head of Petroleum Production Engineering Department, Tulsa, Oklahoma.

PRODUCTION RESEARCH ENGINEER

Experienced Research Engineer to direct and conduct fundamental and applied research in the field of reservoir mechanics. Ph.D. or equivalent. Position permanent. Salary open.

GULF RESEARCH & DEVELOPMENT COMPANY
P. O. Drawer 2038, Pittsburgh 30, Pa.

EQUIPMENT INSPECTION ENGINEERS SOUTH AMERICA

A major oil company affiliated with Standard Oil Company (N.J.) requires graduate engineers with several years refining process equipment inspection experience. Must be qualified to interpret codes and specifications and predict equipment renewals and recommend replacement equipment.

Write giving age, marital status, education and full details of experience.

Box 308-D
Radio City Station
New York 19, N. Y.

FOREIGN SERVICE

Empresa Colombiana de Petróleos at El Centro, Colombia, on the De Mares Concession, has immediate opening for:

Chief Exploration Geologist

Proficient manager and organizer with extensive experience in finding oil by surface and geophysical methods. Duties will include developing an exploration department and recommending exploration tests on the De Mares Concession with an area of 1,250,000 acres.

Write giving full particulars of personal history and work experience. Please include telephone number.

Replies confidential

Box G-412

The Oil and Gas Journal

Tulsa, Oklahoma

HELP WANTED

WANTED by Independent Consultant and Service Organization: Recent graduate Petroleum or Geological Engineer. Principal duties in core analysis work. In reply please advise educational background and salary expected. P. O. Box 1939, Abilene, Texas.

CANADIAN Sales Representative contacting pipe-line companies and contractors for pipe-line equipment and materials. Box G-411, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS & GEOLOGISTS: Rocky Mtn. positions with Majors and Independents. Need specialists in drilling, production, reservoir. Also process engrs. and refinry supts. Professional Placement Service, 516 University Bldg., Denver, Colorado.

Construction Personnel

JOB SUPERINTENDENT

ALSO

ELECTRICAL ENGINEER

Petroleum Refinery Construction

SAO PAULO, BRAZIL

Do Not Reply Unless You Qualify as Follows:

JOB SUPERINTENDENT

Accredited college degree in Civil, Mechanical or Chemical Engineering and minimum five years' responsible supervisory experience as superintendent directing all phases of operations in petroleum refinery construction.

or

Minimum two years' accredited college engineering and ten years' experience stated above.

ELECTRICAL ENGINEER

Accredited college degree in electrical engineering and minimum six-years' responsible supervisory experience directing electrical operations in petroleum refinery construction.

Applicants must have initiative and qualifications pertinent to correlating designs with job site conditions.

These two challenging positions offer excellent salaries plus subsistence allowance. Selected applicants' immediate families transported and returned at our expense.

Applications must include complete detailed chronological history of education (naming schools and colleges attended, degrees received), names of employers (including periods employed, positions held, salaries received, nature and location of projects supervised). Name past employer references we are permitted to contact prior to interview.

Applications Are Confidential

Interviews arranged in New York City at our expense. Send complete information requested to PERSONNEL DEPARTMENT:

HYDROCARBON RESEARCH, INC.

115 Broadway New York 6, N. Y.

HELP WANTED

SEISMIC PERSONNEL needed for United States and Canada by well known and expanding contract geophysical company. Address Box E-863, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST for full time employment with small Producing Company. Would prefer man having several years experience in Oklahoma. Would operate from Tulsa office. Box G-430, The Oil and Gas Journal, Tulsa, Oklahoma.

SOUTH AMERICA. These jobs are with one of the better oil companies. Our fee paid. Mechanical Engineer—graduate, no experience required. Petroleum Engineer—graduate, no experience required. Chemical Engineer—graduate, no experience required. Mud Technician—two or more years' experience, single. Accountant—college graduate, Accounting major, single. All information confidential and should be mailed to CHAS. J. LOVELESS PERSONNEL SERVICE, 616 S. Main, Tulsa, Oklahoma. Phone 3-5168.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

OIL Industry Employment Service, 405 Tuloma Bldg., Tulsa, Okla. 4-5974. Tom Robinson, owner. For Technical and Trained Personnel, including LPG.

CHEMICAL or Petroleum Engineer for work in natural gas and gasoline field with a progressive independent in Permian basin area of West Texas. Experience desirable but not required. Salary commensurate with ability. Include education and complete brief of experience with salary expected in first reply. Replies confidential. Box G-419, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM GEOLOGIST: About 35 years of age who has had experience in Permian and Pennsylvanian areas, as in West Central and North Texas, Oklahoma and Kansas, both subsurface and surface. Will headquarter in Fort Worth but must be willing to be away from home a reasonable amount of time. Give details of education, experience and salary expected. HILL & HILL, Attention: R. R. Thompson, Geologist, 1325 Forth Worth National Bank Building, Fort Worth 2, Texas.

SITUATIONS WANTED

GRADUATE Engineer: 6 years Mechanical Designing and Drafting experience. Age 33, married, prefer Southwest location. K. Ackermann, 3713 Kenilworth Avenue, Berwyn, Illinois.

EXPERIENCED PETROLEUM geologist, seven years western Oklahoma, West Texas, three years Rocky Mountains, three years California, surface, subsurface, well sitting, photo. Location open. Box G-391, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED LEASE Pumper and Production man, married, age 30, wishes to make connection with progressive firm. Fully qualified, dependable. Would move to any location. Box G-431, The Oil and Gas Journal, Tulsa, Oklahoma.

OFFICE MANAGER, Accountant, Executive Assistant, age 33. Familiar operation medium sized oil production and exploration company. Wish to relocate 150 miles radius Dallas, Texas. Box G-416, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM Engineer: 8 years varied production, drilling and workover experience. Desires change. Will consider any location. Box G-414, The Oil and Gas Journal, Tulsa, Oklahoma.

COLLEGE graduate, age 39, married, 15 years experience drilling and production management with contractors and majors Gulf Coast Area. Desires permanent position with growing organization. Box G-405, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION Superintendent — Desires change. 15 years' experience West Texas and New Mexico. Interested Lea County, New Mexico, or adjacent area. Box G-407, The Oil and Gas Journal, Tulsa, Oklahoma.

CHIEF Geologist, independent oil company desires position with independent or small major. Location open. Box G-413, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

GEOLOGIST—age 33, married, six years Gulf Coast experience. Desires immediate employment any location. Box G-420, The Oil and Gas Journal, Tulsa, Oklahoma.

RADIO ENGINEER, graduate, FCC license, site survey and licensing experience, five years in V.H.F. and Microwave field, desires position with pipe line company. Box G-421, The Oil and Gas Journal, Tulsa, Oklahoma.

RESEARCH GEOLOGIST—Stratigrapher, year top level research with major in sedimentary traps, complex facies, structure. Graduate study stratigraphy, structure. Age 28, wife. Able, mature, responsible, handle independent assignment. Desire active position pursuing complex stratigraphy, structure problems. Gulf, Southwest, West. Box G-422, The Oil and Gas Journal, Tulsa, Okla.

PETROLEUM ENGINEER. Five years drilling, production, and reservoir engineering experience with major on Gulf Coast. Looking for opportunity and responsibility with independent. Box G-426, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER, employed, 8 years experience with major in field, staff, and reservoir in Gulf Coast and East Texas desires position with independent. Box G-427, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE MECHANICAL Engineer, married, six years experience in drilling and production with major company on Gulf Coast, desires position with independent producer in Corpus Christi area. Box G-425, The Oil and Gas Journal, Tulsa, Oklahoma.

PROCESS SUPERVISOR, Chemical Engineer, age 34, 10 years experience in refinery design, economics, and process supervision. Desires supervisory or technical position in progressive refinery or petrochemical plant. Box G-424, The Oil and Gas Journal, Tulsa, Oklahoma.

RUSTY MACHINERY SALESMAN: Being released from duty as Captain of Navy ship 15 June. Age 30, Annapolis graduate, experienced with drilling equipment. Can sell, advertise or administrate. Box G-428, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED oil operator wants to represent parties planning active drilling program in Texas, retainer and interest basis. Bank references. Box G-383, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST — 32, family, seven years thorough major company exploration experience, geology and geophysics, both field and home office prospect finding and evaluation, wants job with independent company Rocky Mountain Area. Box G-397, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL Refinery Sup't Available, Prefer Marine, Bulk Station or Pipeline Terminal Supervision. Age 50. Box G-396, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. 1628, Ph. No. 3-3141, Hobbs, New Mexico

OIL SHOW HOUSING

MODERN PRIVATE three and four bedroom homes for rent during Oil Show. Conveniently located. Complete occupancy. Prefer 10 day contracts. Contact Sam Morrow, Phone 64021, 1815 East 17th St., Tulsa.

FOR SALE—MAPS

WILDCAT MAPS

PERMIAN BASIN of W. Tex. and S.E. N. Mex.
or
WILLISTON BASIN—U. S. and Canada
Complete coverage, up-to-date wildcat operations. Over-all dimensions 28" x 28". **$3.50 per copy.**

Midland Map Company

Dept. A, Box 1211, Midland, Texas

LEASE AND DRILLING BLOCKS

SEE A. L. Bowles, Rollow Building, Ada, Oklahoma, for drilling deals.

FOR SALE: 155 acres on promising structure. Producing oil and gas wells on north and west. John Harlow, Louisburg, Kans.

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

10,000 ACRES Western Illinois. Have test hole down 1,000' and want partner with capital to drill approximately 2,700' deeper. Will consider any worthy proposal. Box 192, Cedar Grove, W. Va.

HAVE six sections Federal lease, rent paid three years. North, East and South of deep test now drilling near Florence, Pinal County, Arizona. Close enough for excellent speculative opportunity. Box 842, Scottsdale, Arizona.

LEASE — 160 acres, NE4, 28 - 29n - 23w, Harper County, Oklahoma. $1600.00. A. J. Geiger, Route 15, Box 57, Tulsa, Oklahoma.

LEASES ROYALTIES

Producing and Nonproducing

Bought and Sold—Any Area

Inquiries Invited

B. D. BUCKLEY

6635 Delmar Ave., St. Louis 5, Mo.

OIL OPPORTUNITY

Offset acreage, 200 ft. to major oil company's new producing well, depth 2,000 ft., allowable 30 bbls. per day, also have excellent geological wildcat block ready for immediate drilling, 3,400 ft.

O. B. KLEIN

Ph. 307 Taylor, Texas

S. E. NEW MEXICO POTENTIAL OIL FIELD

Well to drill offset to S. I. well. Two indicated productive zones in Permian. Recommend participation this important area. Complete technical report on request.

W. J. PETERMAN, Geologist

Portales New Mexico

WANTED

DRILLING DEALS

PRODUCTION

WILL BUY SETTLED OR NEW DISCOVERY PRODUCTION

WILL DRILL WILDCAT OR PROVEN DEALS

in New Mexico — Oklahoma — Texas
Williston Basin—Rocky Mountain

Will give quick reply. Send complete information to Box G-423, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

DO YOU Want Capital? Then for a substantial interest in your producing oil and/or gas properties without your risking a loan-squeeze or sacrifice-sale will you accept adequate working capital to meet obligations, drill more wells, or acquire more producing leases? Box G-429, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING DEAL WANTED

Have spudders, labor, cash and repressuring experience. Would like to make drilling deal on shallow repressuring project for part cash and interest.

Box G-403, The Oil and Gas Journal, Tulsa, Oklahoma

ROYALTIES

WILL PURCHASE production, producing royalties or other good investments. Newlun Royalty Company, Box 1324, Denver 1, Colorado.

WE WILL buy producing or non-producing oil royalties. Standard Security Company, 111 Broadway, New York 6, N. Y.

PRODUCING ROYALTY and overrides for sale. Wire-write-call for particulars. JACK EAGLE, 706 City Natl. Bldg., Okla. City, Okla. REgent 6-7027.

QUICK CASH: Producing royalties, Overrides or Production . . . no delay. Phone 72-4533, Robert L. Kinkaid . . . P.O. Box 26, Tulsa, Oklahoma.

ROYALTIES WANTED

Producing Royalties
High Grade Only
Send Full Particulars
Address

C. C. HARMON

719 World Bldg., Tulsa, Okla.
P.O. Box 2151

PRODUCTION WANTED

INDEPENDENT Oil Company desires to purchase production amounting to at least 1,000 barrels per day. Submit full details, together with competent engineering report. Confidential. Box G-404, The Oil and Gas Journal, Tulsa, Oklahoma.

REAL ESTATE

COMMERCIAL Sites (100 x 235 ft.), Residential lots (75 x 140 ft.) on Highway 83 just north of Minot (restricted to new construction). L. A. Joyce, Box 575, Dial 37-127, Minot, North Dakota.

OIL OFFICES AVAILABLE SOON

In Roswell, New Mexico, Corner First and Main, 14 offices, can arrange for 20 if needed. See or write

E. P. MALONE
Care of Roswell State Bank
Roswell, New Mexico

WILDCAT COMPLETIONS

(Continued from page 193)

Logan County: A. R. McElreath and Texas Pacific Coal & Oil Co. 1 McKean-Knox, NW NW SW 4-15n-1e. Dry. TD 5,644 ft.

*McClain County: K. A. Ellison 1 Tankersley, NE NW 25-8n-4w. IPF 125 BOPD, 39°, second Bromide 10,450-90 ft. TD 11,308 ft. (New pool.)

McCurtain County: Noel Hopson 1 Miller, NE SE NE 36-7s-22e. Dry. TD 118 ft. Eureka Drilling Co. 1 Sanders, NW NW SW NW 6-8s-25e. Dry. TD 1,472 ft.

Noble County: Gardner and D&L Oil Co. 3 Ebersole, NW SE NW 11-21n-1w. Dry. TD 3,641 ft.

Seminole County: S&S Drilling Co. 1 Wood, SE SE SW 7-5n-7e. Dry. TD 2,193 ft.

KANSAS

Butler County: Franco-Central-Rex & Morris 1 Lucas, SE SW SW 24-28s-6e. Dry. TD 2,856 ft.

* Ellis County: Peel-Hardman 1 Dumler, SW SW SW 19-15s-17w. IPP 331 BOPD, Arbuckle 3,556-63 ft. TD 3,563 ft. (Opens Wheatland Southwest pool.)

McPherson County: Anschutz Drilling Co. 1 Almstrom, NE NE NW 26-18s-4w. Dry. TD 3,791 ft.

Pawnee County: C. Todd 1 Wedel, NW NW SE 14-21s-16w. Dry. TD 3,860 ft.

* Rooks County: Trans-Era 1 Colby, NE NE SW 27-10s-17w. IPP 85 BOPD, Lansing-Kansas City 3,374-86 ft. TD 3,679 ft. (Opens Colby pool.)

GMR 1 Stucky "A," SW NW NE 32-9s-18w. Dry. TD 3,760 ft.

Saline County: National Associated Petroleum Co. 1 Pistora, SE NW SW 22-13s-5w. Dry. TD 3,952 ft.

NEBRASKA

Cheyenne County: Service Drilling Co. 1 Zimola, NW NW NW 5-13n-47w. Dry. TD 4,190 ft. Skull Creek 4,179 ft.

Ohio Oil Co. 1 H. Johnson, NE NW SW 27-15n-48w. Dry. TD 4,550 ft.

National Associated 1 Ehmke, NW NW NW 18-15n-50w. Dry. TD 5,034 ft. "J" sand 4,956 ft.

Kimball County: Miracle & Fifer 1 State, NW NW NW 36-13n-54w. Dry. TD 485 ft. (Abandoned drill collars lost in hole.)

SOUTH DAKOTA

Dewey County: Youngblood & Youngblood 1 Galvin, C SE SE 25-16n-22e. Dry. TD 6,325 ft. pre-Cambrian 6,312 ft.

CALIFORNIA

* Kern County: Bankline Oil Co. 47-24 Metson, SW SW 24-11n-23w. IPP 80 BOPD, 12°, perforations 1,013-1,440 ft. TD 1,450 ft. (New Miocene sand field discovery in Santiago Creek area.)

Gilliland Oil Co. & C. O. Davis 9 Alferitz, 14-25s-18e. Dry. TD 1,680 ft.

Shell Oil Co., Inc. 47X-24 Hernstadt, 24-27s-19e. Dry. TD 4,400 ft.

H. H. Magee, Opr. 1 Cortner, 30-25s-19e. Dry. TD 4,293 ft.

Edward Nepple 1 Reischman, 24-30s-29e. Dry. TD 1,280 ft.

Shell Oil Co. 12 Mathews fee, 4-27s-28e. Dry. TD 2,170 ft.

Ferguson & Bosworth 2 Edwards, 24-29s-20e. Dry. TD 748 ft.

D. K. Partnership 3, 89-20 "Well," 20-11n-18w. Dry. TD 3,049 ft.

Los Angeles County: General Exploration Co. 1 Fluor Corp. 18-2s-12w. Dry. Deepened from 6,520 to new TD 8,768 ft.

Union Oil Co. 2 Lindauer, 32-2s-10w. Dry. TD 5,745 ft.

MONTANA

McCone County: Shell Oil Co. 42-19-B NPRR, CS½ SE NE 19-22n-48e. Dry. TD 9,780 ft. Ordovician 9,520 ft.

Stillwater County: Moncana Petroleum, Inc. 1 Murray, NW NE NE 24-3n-22e. Dry. TD 5,766 ft. Cambrian 5,640 ft.

WYOMING

* Crook County: True, Brown, Fulton, Gower & Winegar 1 Stevenson, C NE SW 5-49n-68w. IPP 30 BOPD, Fuson 6,292 ft. TD 6,300 ft.

COLORADO

* Logan County: Ryan Oil Co. and Falcon Seaboard and Allied Material Corp. 1 State, NW NW NW 16-8n-54w. IPF 10 BOPH, "J" sand 5,358 ft. TD 5,453 ft. (New pool).

Harry Royster 1 Wilcox, NW NW NW 7-7n-50w. Dry. TD 4,825 ft. Skull Creek 4,818 ft.

Roden Darden & McRae and Balderson 1 Reimers, SE SW NW 2-11n-54w. Dry. TD 5,664 ft.

Moffat County: J. Ray McDermott 1 Government, SW SW SE 26-12n-98w. Dry. TD 7,009 ft. Tertiary sands.

LEGAL

THE DIRECTOR, BUREAU OF LAND MANAGEMENT, U. S. DEPARTMENT OF THE INTERIOR, Washington 25, D. C., subject to the provisions of Public Land Order 860 of August 12, 1952, offers through sealed bids at a cash bonus per acre, an oil and gas lease for 212.24 acres within the Smolan oil field and comprising the warehouse site of the Smoky Hill Air Force Base, Saline County, Kansas. Bids are to be opened in the office of the Director at 1 p.m., E.S.T., May 6, 1953. Copies of the form of lease and complete information will be mailed upon request or may be obtained from the oil and gas supervisor, U. S. Geological Survey, Post Office Building, Tulsa, Oklahoma. Each bidder must submit 1/5 of the amount bid in cash, or certified check, or money order, payable to the Treasurer of the United States. Envelopes containing bids should be plainly marked that they are not to be opened before the date and hour set out herein and should show the area involved in this sale. The lease will provide for a royalty of 12½ per cent and an annual rental or minimum royalty of $1 per acre. Prior to issuance of the lease the successful bidder will be required to pay the remainder of the bonus and the first year's annual rental, to furnish an acceptable surety bond in the sum of $15,000, and to qualify as to citizenship as prescribed for leases under the Mineral Leasing Act of August 8, 1946, (60 Stat. 950, 30 U.S.C. 181). The Department reserves the right to reject any and all bids.

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American Steel & Wire Co. 14, 15
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Appleton Electric Company 176
Ardun Supply Company 146
Armstrong Machine Works 36
Baash-Ross Tool Company 125
Baker Oil Tools, Inc. 70, 180
Beaird Company, Inc., The J. B. 103, 104
Bethlehem Steel Co. 90
Black, Sivalls & Bryson, Inc. 132
Bucyrus-Erie Co. 24
Byron Jackson Co. Front Cover
Carbide and Carbon Chemicals Company A Division of Union Carbide and Carbon Corporation 140
Carpenter Steel Company, The 8
Caterpillar Tractor Co. 7
Chain Belt Company 45
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Chicago & Southern Air Lines 120
Chicago Bridge & Iron Company Inside Front Cover
Christensen Diamond Products Co. 126
Classified Advertising 198, 199, 200, 201, 202
Cleaner Pipelines Co. 161
Coleman Instrument Company 190
Construction Machinery Co's. 177
Cooper-Bessemer Corp., The 89
Coyle Lines Incorporated 183
Crane Co. 2
Cummins Engine Co., Inc. 59
Darling Valve and Mfg. Co. 58
Dean Brothers Pumps, Inc. 163
Desco Service Co. 160
Dolge 182
Dowell Incorporated 192
Drilling & Service, Inc. 191
Dynamatic Corporation, Subsidiary of Eaton Manufacturing Company 188
Eaton Manufacturing Company, Axle Div. 187
Edward Valves, Inc. 18
Electric Steel Foundry Co. 184
Empire Trust Company 183
Emsco Manufacturing Company 53, 54
Ethyl Corporation 19, 20
Fluid Packed Pump Company 121, 122
Fluor Corporation, Ltd., The 56
Foster Wheeler Corp. 9
Foxboro Company, The 12
General Electric Company 158, 159
General Tire & Rubber Co., The 39
Goodrich Company, B. F. 3
Grancell, I. H. 169
Grinnell Company, Inc. 137
Griscom-Russell Co., The 13
Guiberson Corporation 171
H & M Pipe Beveling Machine Co. 163
Halliburton Oil Well Cementing Co. 28, 29, 57
Houston Ready-Cut House Co. 182
Hughes Tool Co. Back Cover
Inferno Co., The 170, 185
Infilco, Inc. 182
Iverson Supply Company 50
Johns-Manville Corporation 23
Johnston & Jennings Company, The, Division of Pettibone Mulliken Corporation 135
Johnston Testers, Inc. 23
Jones & Laughlin Steel Corporation Supply Division 28
Kaiser Steel Corporation 55
Keasbey & Mattison Company 16
Kewanee-Ross Corporation 22
Kinzbach Tool Co., Inc. 112
Koch Engineering Company, Inc., The 128
Koppers Company, Inc. 37
Kraloy Plastic Pipe Co., Inc. 133
Lane-Wells Company 41
Lehman Brothers 193
Levingston Shipbuilding Co. 162
Marsh Instrument Co. 111, 148
Martin Manufacturer, John N. 129
Mayes-Bevan Company 172
Medical Supply Company 119, 186
Midwest Piping Company, Inc. 30
Minneapolis-Honeywell Regulator Co., Industrial Division 11
Mission Mfg. Company 65
Mixing Equipment Co., Inc. 144
Murphy, Frank W. 148
National Airoil Burner Co., The 185
National Supply Co., The 35
National Tank Company 204
Nelson Electric Supply Co. 119
Nordberg Mfg. Co. 142
Norris Manufacturer, Inc., W. C. 68
OPW Corporation 146
Oil and Gas Journal, The 111
Oil Center Tool Co. 152
Oil Well Supply Co. 4
Pacific Car and Foundry Company 123
Parelex Corporation 185
Peerless Supply Co., Inc. 163
Penberthy Injector Co. 5
Pipe Line Service Corp. 60
Pittsburgh Coke & Chemical Co. 34
R-P&C Valve Division, American Chain & Cable 181
Raybestos-Manhattan, Inc., Packing Div. 130
Rector Well Equipment Co., Inc. 170
Reed Roller Bit Company 61
Refinery Supply Co., The 148
Reliance Electric and Engineering Co. 31
Republic Steel Corporation 27
Reynolds Metals Co. 32, 33
Rockwell Manufacturing Company 52
Rockwood Sprinkler Company 51
Roebling's Sons Company, John A. 38
Sawyer-Jensen-Ross Co. 160
Schulz Corp. 170
Seismograph Service Corp. 175
Service Foundry, A Division of Avondale Marine Ways, Inc. 146
SKF Industries, Inc. 49
Smith Corporation, A. O. 47
Snap-On Tools Corporation 68
Socony-Vacuum Oil Co., Inc. 48
Somerville Construction Company 161
Spang-Chalfant Division of The National Supply Co. 35
Standard Safety Equipment Company 112
Standco Brake Lining Co. 170
Steel Forgings, Inc. 186
Taylor Forge & Pipe Works 154
Taylor Instrument Companies 62, 63
Timken Roller Bearing Company 21
Tulsa Crating Co. 112
Tuthill Pump Company 67
Twin Disc Clutch Co. 113
Ultra Violet Products, Inc. 163
Union Asbestos & Rubber Co. 46
Union Carbide and Carbon Corporation, Carbide and Carbon Chemicals Company 140
U. S. Steel Corp. Subsidiaries 4, 14, 15
United Supply & Manufacturing Co. 188
Viking Pump Co. 135
Victor Products Corp., The 186
Visco Products Co., Inc. 85
Vogt Machine Co., Henry 44
Wall Colmonoy Corporation 64
Warner Lewis Company 160
Watson-Stillman Fittings Division, H. K. Porter Company, Inc. 167
Wershow, Milton J. 189
White-Roth Machine Corporation 178
Williams Brothers 162
Williamson, Inc., T. D. 131
Wilson Manufacturing Co., Inc. 134, 169, 170, 180, 182, 185
Wisconsin Motor Corporation 134
Wood's Sons Co., T. B. 165
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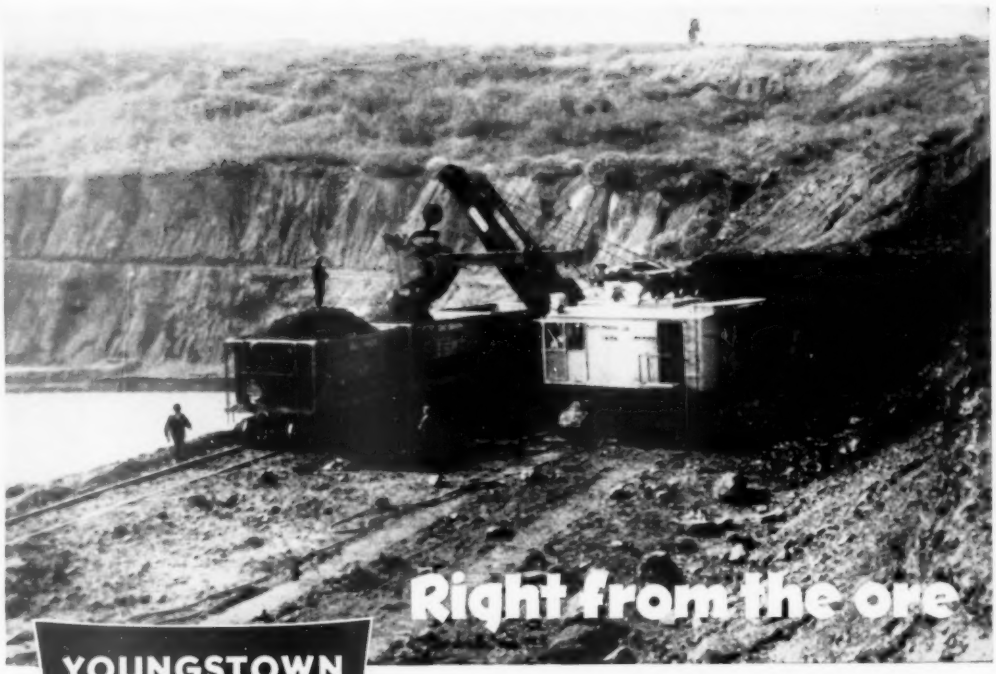

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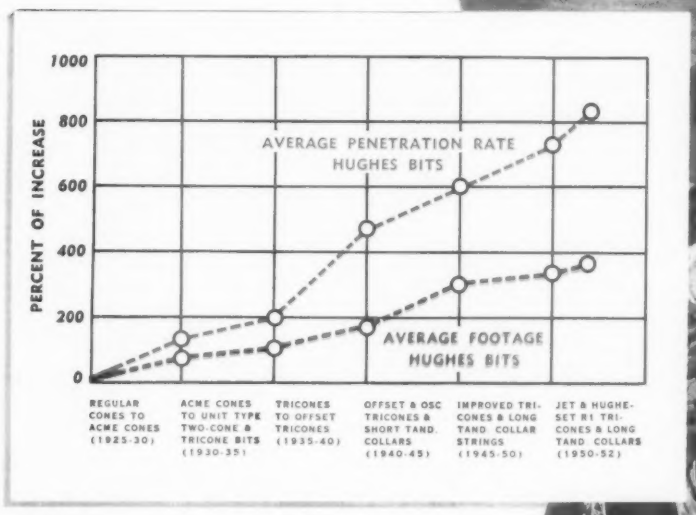
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